ARMY NATIONAL GUARD
DG 415-5
GENERAL FACILITIES INFORMATION DESIGN GUIDE

NATIONAL GUARD BUREAU
INSTALLATIONS DIVISION
111 SOUTH GEORGE MASON DRIVE
ARLINGTON, VA 22204-1382

FOREWORD

This General Facilities Information Design Guide (DG 415-5) was published by the National Guard Bureau, Army Installations Division (NGB-ARI). DG 415-5 applies to all projects for new construction (including additions) as well as alterations to and rehabilitation and conversion of existing facilities. It is intended to assist the States, Possessions, design agencies, and design architect-engineer in gaining an understanding of the general functions and environmental considerations to address in the design and construction documents for the Army National Guard (ARNG) facilities that qualify for support from Federal funds. This design guide does not contain criteria but refers readers to sources of criteria in other publications that relate directly to the specific technical design requirements.

DG 415-5 contains functional and technical information common to all ARNG facilities. It should be used in conjunction with the design guide developed for the specific facility type to assist in the design process.

Distribution is limited. However, authorized users of the NGB Guard Knowledge Online (GKO), can obtain an electronic copy at (gkoportal.ngb.army.mil/C12/Installations) Design Guide Library site. All users are encouraged to submit comments and suggestions to improve this document by completing a DA Form 2028, “Recommended Changes to Publications and Blank Forms,” and sending it directly to:

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CHAPTER 1

GENERAL INFORMATION

1-1 PURPOSE: PERFORMANCE DESIGN GUIDELINES

This General Facilities Information Design Guide (DG 415-5), along with the facility-type design guides (DGs 415-1 Readiness Centers, 415-2 Logistics Facilities, 415-3 Aviation Facilities and 415-4 Training Site Facilities), sets forth functional and technical design and planning guidance to use in the development of military construction (MILCON) projects.

1-1.1 Audience

These design guides are written for the design architect-engineer (A-E) who will be preparing design and construction documents as well as for construction and facilities management officers (CFMO) and other Army National Guard (ARNG) personnel who will be planning, reviewing, and approving the facility design. It is the intent of the National Guard Bureau, Army Installations Division (NGB-ARI) to encourage the design A-E to design high-quality, user-friendly, functional, energy-efficient, and sustainable facilities using the latest engineering and construction industry standards.

To aid the reader, DG 415-5 includes the following:

- Appendix A, References, contains a detailed list of reference documents.
- Appendix B, Glossary, defines all abbreviations and acronyms used in this design guide as well as specialized terms that are used in this design guide.

1-1.2 Master Plan Compliance

Before project initiation, the CFMO should provide the design A-E with an approved working or preliminary master plan for the proposed facility site. The State Military Department should provide special instructions for any deviations from the master plan. The design A-E should consider sustainable material types and construction industry standards indicated in these design guidelines to establish the minimum project quality.

1-2 ROLE OF THE FEDERAL GOVERNMENT

Title 10 of the United States Code (U.S.C.) authorizes contributions of Federal funds to the States and possessions to provide facilities for the training and administration of Reserve components of the Armed Forces. NG PAM 415-12 establishes facilities allowances, and these design guides provide the design and construction performance recommendations governing such contributions from Federal funds that the NGB Chief administer. Each such contribution is subject to the terms of a Military Construction Cooperative Agreement executed specifically for providing designated facilities. These agreements are executed under authority granted in Title 10, United States Code, Chapter 1803, which states that all work “shall be done according to the laws of that jurisdiction and under the supervision of its officials, subject to inspection and approval

of the Secretary of Defense." The United States Property and Fiscal Officers (USPFO) are responsible for disbursement of Federal funds contributed toward the construction of State ARNG facilities projects.

1-3 NATIONAL GUARD BUREAU POLICY

NGB-ARI has specific policy regarding the types of buildings and installed equipment eligible for Federal support in ARNG facilities, as outlined in the following paragraphs.

1-3.1 Technical Instructions Criteria

Where specified guidelines are not set forth herein or in the program documents, design criteria in NGR 415-10, NG PAM 415-12, Unified Facilities Guide Specifications and MIL-STD 3007 apply for all MILCON projects.

1-3.2 Construction and Equipment Materials Criteria

The materials and equipment allowances are to be considered the maximum allowable using Federal contributions toward construction costs. Use of the full maximum allowances is permissible rather than mandatory because local conditions may justify the actual facility constructed.

A project's DD Form 1390/91documents the approved scope and Federal share for each component of the project, and the CFMO may not design or construct beyond this level without receiving NGB-ARI approval or an amended funding document.

1-3.3 Federal Support

In order for an ARNG facilities project to qualify for Federal support, the materials and equipment incorporated, built-in, or installed shall be submitted and approved by NGB-ARI at or prior to Final Design (95%).

1-3.4 Non-Federal Funds

These design guides do not preclude the use of non-Federal funds to provide materials, equipment, or features of higher quality than suggested, provided that the Federal share of the operating and maintenance cost does not increase. The cost of such improvements, however, must be clearly determinable as separate bid items or specified as a contractor's option. If the amount of higher-quality features, equipment, materials, and space not Federally supportable is unusually large and makes separate bidding impractical, the State and the Federal government (NGB-ARI) must negotiate an agreement to establish the limitations of the Federal share of the overall project construction costs. This is usually expressed as a percentage of the total construction cost.

1-3.5 Equipment Not in Contract

Portable furniture and equipment may not be supported by Federal construction funds. Examples are desks, chairs, tables, stools, map cases, unattached shelving, fire extinguishers, coats of arms, State seals, memorial plaques, entrance door mats, and waste receptacles.

1-3.6 **Performance Focus**

NGB-ARI encourages the use of contractor's options and performance-type specifications as a means of ensuring procurement of the most economical system or component. The materials and methods of construction proposed for use on a given facility must have been used on a sufficient number of State facilities to establish a documented record of performance.

For functional area flexibility, the design A-E may increase or decrease individual functional areas by exchanging a percentage of the area between functions as per NG PAM 415-12, Chapter 1-7. However the total net functional area may not exceed that authorized for the facility unless it is funded with other than Federal funds.

1-3.7 **Accessibility**

All ARNG facilities shall be designed and constructed in accordance with Public Law 90-480, the Architectural Barriers Act (ABA) of 1968, as amended. The document that sets standards as a result of this law is the Uniform Federal Accessibility Standards (UFAS). These standards primarily address projects in the Federal sector or projects built and leased with Federal funds. Currently, UFAS applies to all ARNG projects.

After the Americans with Disabilities Act (ADA) of 1990 were enacted, the U.S. Access Board under the Department of Justice has regularly updated the ADA Accessibility Guidelines (ADAAG). These guidelines address projects in the private sector (places of commercial accommodation and commercial facilities) and the public sector (State and local government facilities). Currently, ADAAG applies to all ARNG projects.

New guidelines, which combine UFAS and ADAAG into one unified standard, were published in the *Federal Register* in July 2004 and became effective on September 21, 2004. This unified standard, the Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, was created under 36 CFR, Parts 1190 and 1191. This rule contains a separate scoping document for ADA facilities, a scoping document for ABA facilities, and a joint technical section referenced by each scoping section. Refer to the summary of the new guidelines in the July 23, 2004, *Federal Register*, which contains a detailed description and background information. ARNG intends to apply this unified standard in lieu of the separate ADAAG and UFAS.

As noted in the preamble to the UFAS, the basis for the first accessibility standards adopted by the Federal government and most State governments was ANSI 117.1, Accessible and Usable Buildings and Facilities. This code has been recognized by the private sector and the Council of American Building Officials, and is the accessibility code referenced in the International Building Code (IBC). Because ARNG projects follow a statewide building code in many instances, this code may apply when referenced by the adopted model statewide building code. The design A-E is directed to compare the accessibility codes and use the more stringent one. The new, unified Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines may reduce the potential for conflicts with other regulations developed by State agencies.

1-3.8 Hazardous Materials Abatement

The design A-E will need to comply with all U.S. Environmental Protection Agency (EPA) reference documents. The design A-E shall also consult with the CFMO to determine any special State and local requirements.

1-3.8.1 Asbestos Removal

Before facility buildings are programmed or planned for alteration, rehabilitation, and addition, a survey should be undertaken to establish the amount, location, and estimated cost of asbestos removal. A letter should be sent from the CFMO to NGB-ARI to indicate that there is an asbestos problem and that authorization to do an asbestos survey and design for removal is urgently needed because asbestos has to be removed prior to any construction.

The cost of asbestos removal should be included as an item in the program and funding documents. The cost of the survey and asbestos removal is 100 percent supportable by Federal funds for all functional areas authorized in the Federal project requirements. If only a portion of an existing building requires alteration or rehabilitation, all the asbestos in the building must be removed before beginning the alteration or rehabilitation phase of the project. If emergency repairs (such as re-insulating a boiler) are needed after asbestos removal, the asbestos removal portion of the project should include the repair cost.

1-3.9 Value Engineering Studies and Life Cycle Cost Analysis

The State is encouraged to contract the services of a Certified Value Specialist (CVS) to lead the value engineering study (VES) to ensure that design solutions are cost effective. The VES also serves as a means of identifying opportunities for substitutions during the design process, should the project exceed budget requirements, while still maintaining the level of quality performance expected.

The VES should to be accomplished early in project development once the design concept and the building systems have been initially defined. Each item in the VES should be clearly defined by narrative and drawing, and the cost savings should be shown with related calculations. The specific, formally documented VES recommendations should be incorporated in the Preliminary (35-50%) Design milestone design review submission to NGB-ARI. Before proceeding with project development beyond the Preliminary milestone, all VES decisions should be made regarding which recommendations to implement immediately and which to consider contingent items to incorporate if costs continue to exceed budget. The VES should be a 3-day limited workshop since the site has been selected by the State prior to the design phase. The VES Workshop should adhere to the 5-step methodology and approach prescribed by the Society of American Value Engineers (SAVE) International.

An integral part of the VES process is life cycle cost analysis (LCCA), which is a systematic means of evaluating the entire building initial, energy, operation and maintenance cost over an extended period of time. A formal LCCA should be used to compare system alternatives. This process requires caution because the recommended system may increase the facility initial cost above the approved programmed funding amount.

1-3.10 **Signage and Graphic Standards**

All signage and graphics at a facility should comply with requirements of the State Military Department; General Services design standards or industry standards. If the proposed facility is located on an U. S. Armed Forces military installation, local signage standards should be followed.

1-3.11 **Project Scheduling Requirements**

(NGB-ARI will provide form)

1-3.12 **Warranty Requirements**

NGB-ARI requires that products and systems have warranty provisions according to industry standards. The following list identifies the majority of these elements that may occur in an ARNG facility.

DIVISION 2 – SITE CONSTRUCTION
- Water Distribution System
- Packaged Sewage Pumping Station
- Irrigation Systems
- Seeding, Sodding, Plants, and Planting

DIVISION 3 – CONCRETE
- Concrete Surface Sealer
- Glass Fiber-Reinforced Concrete

DIVISION 4 – MASONRY
- Brick Masonry

DIVISION 5 – METALS
- Shop Applied Metal Finishes

DIVISION 6 – WOOD AND PLASTICS
- Laminated Wood Construction
- Polymer Surfacing Materials

DIVISION 7 – THERMAL AND MOISTURE WATERPROOFING
- Waterproofing
- Water Repellent Coatings
- Cementitious Dampproofing
- Exterior Insulation Finish System
- Fireproofing
- Roofing
- Metal Siding and Wall Panels
- Fluid Applied Deck Coatings
- Flashing and Sheet Metal
- Roof Hatches
- Joint Sealants

DIVISION 8 – DOORS AND WINDOWS

Steel Doors and Frames
Wood Doors
Glass Door Assemblies
Aluminum Storefront and Windows
Wood Windows
Skylight Systems
Finish Door Hardware
Glass and Glazing
Curtain Wall Systems

DIVISION 9 – FINISHES
Exterior Studwall System
Ceramic and Quarry Tile
Terrazzo
Acoustical and Other Specialty Plaster Finishes
Wood Flooring
Resilient Flooring
Carpet and Carpet Tile
Fluid-Applied Seamless Flooring
Wall Coverings

DIVISION 10 – SPECIALTIES
Markerboards and Tackboards
Toilet Partitions
Access Flooring Systems
Demountable Partitions
Toilet and Bath Accessories

DIVISION 11 – EQUIPMENT
Window Washing System Equipment
Dock Levelers and Lifts
Food Service Equipment
Detention Equipment
Shooting Range Equipment

DIVISION 12 – FURNISHINGS
Architectural Casework
Window Shades
Entrance Mats

DIVISION 13 – SPECIAL CONSTRUCTION
Prefabricated Wall and Partition Systems
Prefabricated Radio Frequency Shielding Enclosure
Pre-Engineered Buildings

DIVISION 14 – CONVEYING SYSTEMS
Elevators

DIVISION 15 – MECHANICAL
- Plumbing Fixtures and Pumps
- Gas and Vacuum Systems
- Fuel Oil Systems
- Chillers
- Cooling Towers
- Steam Generators
- Unit Heaters
- Packaged Air-Handling Units
- Exhaust Fans
- Fiberglass Reinforced Plastic Ductwork
- Energy Management and Control System

DIVISION 16 – ELECTRICAL
- Wiring Devices
- Lighting Fixtures
- Uninterruptible Power Supply Systems
- Standby Power Generator Systems
- Battery Powered Systems
- Fire Alarm System
- Monitoring and Security Control Systems

1-3.13 **Performance Specifications**

The Unified Facilities Guide Specifications (UFGS) with technical notes is available to the A-E design team via the Whole Building Design Guide website at (www.wbdg.org/ccb/browse_org). However, the A-E is encouraged to suggest areas where a creative solution could be better managed through a performance-based specification for that particular element. Given the dual role of many ARNG facilities, the need for flexibility could become a driver for a creative solution using this method. Such a method could be considered in the following situations:

- Where the desired systems have not evolved to standardized configurations or solutions from manufacturer to manufacturer, or where no alternatives are similar enough that a prescriptive method could be used without inadvertently excluding all other variations of the system desired. Examples are a new integrated system for automated vehicle wash racks, a specialized type of paint removal system, or even a large-scale paint spray system or other industrial-based process.

- Where it is desirable, because of complexity or for other reasons, to delegate the responsibility for designing and integrating a particular system to an industry specialist. An example of this is crane systems.

Careful coordination is required to define the performance-based requirements, criteria, and tests for a particular attribute or system.

The design standards for finishes in ARNG facilities favor a more flexible set of recommendations and parameters for finish performance. The design A-E should continue this flexible approach in the design process, working from a palette of finishes that meet these requirements and criteria. This flexible approach may be extended to the specifications process for finishes, where the requirements and criteria can be well defined.

1-3.14 Operation and Maintenance Design Priorities

Important aspects of the design of all Army National Guard facilities are the selection of maintainable finishes and the provision of access or placement of building equipment and other fixed elements. The following are ways to address concerns in the design process:

- Select finishes based on the durability requirements related to the use of the space.

- Specify slip-resistant floor materials and finishes where water can be tracked in.

- Position heating, ventilation, and air conditioning (HVAC) and other mechanical and electrical components that are located above the ceiling and require servicing within easy reach from below to avoid the need for a service lift and major ceiling disassembly.

- Allocate adequate clearances for the servicing and replacement of large pieces of building mechanical and electrical equipment.

- Provide for ready access to wells and containment systems for inspection.

- Consider the use of a low-power traction elevator system that is competitive in cost with hydraulic units, and consider a machine room that can fit inside the hoistway.

- The designer should specify Total Building Commissioning when programmed in the DD Form 1390/91 funding document at 1% primary building cost.

1-3.15 Applicable Codes and Standards

The references list in Appendix A pertains to national standards. In some instances, a State may have more stringent requirements. The CFMO should provide in writing for the design A-E all categories of State regulations that exceed national standards.

1-3.16 Fire Protection

Fire protection guidelines follow:

- Incorporate efficient and cost-effective fire protection and detection systems in all ARNG facility designs.

- Comply with the requirements for all building space types presented in the International Building Code and National Fire Protection Association (NFPA) standards and with criteria presented in UFC 3-600-01 Fire Protection Engineering for Facilities. Also address State and local requirements that are more stringent than these sources.

- Ensure that the municipal water supply pressure and capacity or independent means (including storage tanks) comply with the water source requirements of the fire suppression systems.

- Provide adequate water source, sprinkler, emergency generator, and alarms systems capacity to accommodate limited building expansion on site.

- Include the means of egress, with all related calculations. Maintain the proper dimensions of all means of egress during detailed design.

- Identify all rated separations, and ensure that all building systems components at these separations support the rating.

- Coordinate smoke evacuation systems with the HVAC design.

- Adequately isolate and vent areas with highly combustible products, including the petroleum, oils, and lubricants (POL) storage.

- Ensure that the antiterrorism/force protection (AT/FP) standoff barrier components include access for fire-fighting apparatus.

- Telecommunication/Information Technology spaces must comply with the above codes for a primary system, a secondary Halon alternative clean agent fire extinguishing system maybe used.

1-3.17 **Occupational Health and Safety**

1-3.17.1 **General Information**

The U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) Standards for General Industry in 29 CFR Part 1910 and DA PAM 40-503, Industrial Hygiene Program, requires that ARNG provide a safe and healthy workplace for its employees. All Readiness Centers with Indoor Firing Ranges, Logistics and Aviation Maintenance facilities must have an Industrial Hygiene (NGB-ARS-IH) technical review prior to construction. Personal protective equipment (PPE) and administrative procedures are only interim measures for controlling occupational hazards. The following paragraphs address other measures.

1-3.17.2 **Noise and Vibration Reduction**

Noise-induced hearing loss is one of the most common occupational hazards. Currently, ARNG uses PPE as the main means of preventing hearing loss; however,

engineering controls would be more effective. Mechanical equipment rooms contribute most of the high noise and vibration levels in buildings. The design A-E should take great care when locating these spaces to avoid adjacencies with incompatible noise tolerances. Mechanical equipment mounted rigidly to the supporting structure produces excessive vibration levels. The design A-E shall select vibration isolation methods to eliminate these problems. For equipment applications the designer should reference ASHRAE Handbook of Fundamentals.

1-3.17.3 **Indoor Air Quality**

The design of the building HVAC and exhaust systems must include indoor air quality features to ensure a safe environment. The design A-E should follow American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 62.1-2004, which recommends the minimum outdoor air rates for buildings, and the American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation Manual for recommended practices related to specific exhaust and ventilation systems design.

A combination ventilation and exhaust system needs to be designed for the specific occupancy and process within each area to meet the indoor air quality standards. The design A-E should establish temperature, humidity, and ventilation criteria for each space and should design special exhaust hoods where necessary. Although specific humidity criteria may not be published for many areas, all conditioned spaces should be designed to maintain not higher than 50 percent relative humidity (RH).

Consideration must be given to air quality in storage rooms and similar spaces. Although these areas are not normally occupied, they may require ventilation, temperature, and/or humidity control to prevent damage to stored material and provide an acceptable environment for personnel using the room.

Air-handling unit (AHU) design should minimize mold and mildew growth inside the units. AHUs should have a filter bank (prefilters @ 30% and final filter @ 85% efficient) base on *ASHRAE Standard 52.1-1992 Atmospheric Dust-Spot Efficiency* rating to prevent dust collection on coils, and drain pans should be properly sloped and provided with condensate traps to eliminate standing water in the units. AHUs should not be operated during construction without proper filters in place, and all filters should be replaced at turnover to the ARNG.

1-3.17.4 **Location of Air Exhaust and Intake**

Exhaust air discharges and vents must be located at a proper distance from intakes to prevent cross-contamination and must be in a location which does not expose people or other buildings to hazardous discharge. Outside air intakes must also be located to minimize induction of vehicle exhaust and other site contaminants; in addition, they must be located and protected as prescribed by antiterrorism requirements. The design A-E should follow the recommended guidelines of ACGIH and local building codes.

1-3.18 **Energy Efficiency**

It is important to emphasize building envelope, mechanical and electrical systems efficiency as referenced in *UFC 3-400-01, Design: Energy Conservation*. An LCCA is to

be performed to evaluate at least two proposed mechanical systems. The Energy Policy Act of 2005 (EPACT-05) amended 2007 published guidelines to design buildings 30% more energy efficient than ASHRAE Standard 90.1-2004 if life-cycle cost effective. The US Green Building Rating System (LEED-NC), discussed in Paragraph 3-2 and ANSI/ASHRAE/IESNA Standard 90.1-2004, will be used to evaluate the building energy efficiency.

The building envelope, mechanical and electrical systems must be designed in accordance with ANSI/ASHRAE/IESNA 90.1-2004 or the State energy codes. The efficiency of motors, boilers, chillers, and other mechanical equipment must conform to the requirements of ANSI/ASHRAE/IESNA 90.1-2004. The use of air-side or water-side heat recovery systems should be considered where they can be applied effectively.

ARNG buildings are frequently occupied on irregular schedules, with many areas used only on weekends and/or at night. Therefore, the mechanical systems should be zoned so that heating, cooling, and ventilation can be reduced in portions of the building when they are unoccupied.

1-3.19 **HVAC System Quality**

When selecting mechanical equipment and designing systems, the A-E should strive for a system that will provide low maintenance and long life while providing a quality indoor environment. The use of rooftop packaged AHUs should be minimized because of their relatively short life and the inconvenience of servicing them. Double-wall AHUs are generally more robust and more easily maintained. Stainless steel condensate drip pans and cooling coil casings extend the life of an AHU and provide a cleaner surface, which reduces growth of mold and mildew. The designer should use ASHRAE Handbooks of Fundamentals, HVAC Applications and HVAC Systems and Equipment as guidance.

On larger installations, hydronic cooling utilizing a central chiller plant should be investigated in lieu of packaged direct expansion (DX) cooling, which typically is more maintenance intensive. The design A-E should avoid using steam for heat distribution as the boiler and piping system are more difficult to maintain than hot water. Direct-fired warm air furnaces and unit heaters typically require more maintenance and have a shorter life than hydronic systems; they should be used only in small installations where a central system is not practical.

1-3.20 **Geotechnical Investigation**

Site selection and Federal support shall conform to NGR 415-5, Chapter 4. Based on a visual observation of the site and knowledge of the local area, an appropriate number of soil borings should be made to determine the nature and consistency of subsurface soil conditions. Additional borings are warranted if the results are inconclusive or insufficient for the foundation and pavement design. The Site Survey Report, to be prepared in accordance with NGR 415-5, must include the results of the investigation of the selected site. The CFMO and NGB-ARI use the completed Soil Bearing Capacity Declaration (NG PAM 415-5, Appendix G) to gauge the adequacy of the site and thus determine whether to grant Federal funds for construction of the facility at that particular

location. This declaration should include the actual allowable design soil bearing capacity.

1-3.21 **Bid Format Information**

Two types of formats may be used for bidding:

- All Bid Formats are located in NG PAM 415-5, Appendix L.

Separate bids must also be obtained for the Intrusion Detection Systems and Interior Intrusion Detection System equipment-in-place, maintenance repair, and other support items to identify the funding support when provided from different accounts or to identify varying proportions of Federal/State cost sharing. Although the bids may be lump sum for each item, the quantity and unit of measure for each should be included, where practical, showing the magnitude of work required.

The bids of all authorized items (including site preparation and the IDS) are to be totaled before listing additive and/or alternative items that are to be supported with other than Federal funds. A written description of each bid is also to be provided to define the scope of work associated with the bid amount.

In addition, unit price bids should be obtained for the various types of work that may have to be increased or decreased during the period of construction, or when the unit cost of work must be utilized to determine the cost of work in excess of authorized amounts (such as excess foundation walls, exterior walls, and interior partitions).

1-3.22 **Commissioning Buildings and Systems**

Total building (enhanced) commissioning is recommended for all ARNG MILCON projects for new construction and major renovation. Fundamental Commissioning of Building Energy Systems is a prerequisite for LEED-NC and Enhanced Commissioning is a one (1) point credit.

The total cost allowed for this activity will be 1% (0.5% (Construction Phase and 0.5% Design Phase) of the Primary Facility Cost as a line item on an approved DD Form 1390/91 Funding Document (0.5%). This cost allowance includes the services of an Independent Commissioning Agent.

Commissioning Defined:

- Commissioning is the systematic process of ensuring through documented verification that all building systems perform interactively according to the documented design intent and the owner's operational needs. (NG Pam 415-5, Chapter 14) Published 31 July 2003.

- Commissioning is the testing, operation and demonstration efforts to verify the intended design as reflected in the contract documents has been achieved in the installed construction. (USACE ER 1110-345-723, Systems Commissioning Procedures: http://www.hnd.usace.army.mil/techinfo) Published 31 July 1995.

- Commissioning is a quality assurance process for buildings from pre-design through design, construction, and operations. It involves achieving, verifying, and documenting the performance of each system to meet the building's operational needs within the capabilities of the documented design and equipment capacities, according to the owner's functional criteria. (ASHRAE Handbook, HVAC Applications Chapter 42, New Building Commissioning: http://www.ashrae.org) Published 2003.

Commissioning with respect to the U. S. Green Building Council Leadership in Energy and Environmental Design for New Construction and Major Renovations (LEED-NC), Energy & Atmosphere;

- EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems are required for all ARNG MILCON projects. The intent is to verify that the building's energy related systems (Mechanical/HVAC/Electrical) are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents. There is no additional cost to the design Architect-Engineer firm for this documentation it is part of the design submittal requirements as stated in NGR 415-5, Chapter 7 Designing MCNG Projects (NG Pam 415-5, Chapter 11, Design Document Submittals).

- EA Credit 3: Enhanced Commissioning, this commissioning process begins early during the design process and execute additional activities after systems performance verification is completed. This requirement is referred to as Total Building Commissioning and will be funded as stated in NGR 415-5, Chapter 8-5 and documented in NG Pam 415-5, Chapter 14.

CHAPTER 2

ANTITERRORISM/FORCE PROTECTION

2-1 GENERAL INFORMATION

Any building or portions of buildings routinely occupied by 11 or more DoD personnel with a population density greater than one person per 430 ft^2 requires the minimum antiterrorism/force protection measures. Compliance with the U.S. Department of Defense (DoD) Minimum Antiterrorist Standards for Buildings (UFC 4-010-01) is not an option. However, the individual State's AT/FP officer's recommendations to the adjutant general determine the level of protection required (the degree to which assets are protected against injury or damage from an attack) at the specific site.

After the acceptable level of protection has been determined, appropriate protective strategies are identified. The strategies may be in the form of planning actions, which could include the reorganization of buildings, addition of site elements, and reorientation of roadways. During the design process, the design A-E shall conduct all protection analysis as described in DA PAM 190-51, DOD Security Engineering Publications UFC 4-020-01FA, UFC 4-020-02FA, UF 4-020-03FA and UF 4-020-04FA. For some protective strategies, the design process may include identification of multiple scenarios or alternatives for achieving the required level of protection. All alternatives should undergo a suitability analysis, which takes into account factors that may limit the feasibility of the concepts. Potential future expansion of the new facilities should be considered in the analysis. Factors limiting effective AT/FP strategies may consist of physical, resource, and political constraints such as land area restrictions.

2-2 DESIGN CONSIDERATIONS

2-2.1 Design Constraints

Design constraints are based on appropriate levels of protection in compliance with AR 190-13, AR 415-15, AR 435-13 and UFC 4-023-03 to provide proper planning, evaluation, application, design, installation, and construction of facility enhancements for physical security and antiterrorism. Limit airborne contamination by effectively designing HVAC systems to reduce potential for chemical, biological and radiological agents from being distributed throughout the building. Provide a mass notification system to notify building occupants of threats and possible responses to reduce the risk of mass casualties.

2-2.2 Standoff Zones

The most significant consideration affecting costs can be the standoff zones. The exclusive standoff zone is the controlled area surrounding a structure, into which only

service and delivery vehicles are allowed. Barriers define the perimeter of this controlled area. The barriers are set at a standoff distance sufficient to reduce the blast effect of a vehicle bomb.

The nonexclusive standoff zone is the controlled area that is used in conjunction with an exclusive standoff zone but provides less restrictive land use. Cars (but not trucks) may be granted uncontrolled access into a nonexclusive standoff zone. The barriers that define the nonexclusive standoff zone perimeter are set at a standoff distance sufficient to reduce the blast effects of a truck bomb detonation on the protected structure.

2-2.3 Site Planning and Landscape Design

Land use planning should take into account the areas associated with proposed force protection measures in the calculation of total project land area requirements. Implementing the appropriate force protection measures at the planning stage can preclude the need for piecemeal and costly security enhancements later in the process. Force protection objectives must be balanced against other planning objectives, such as efficient use of land and resources, and must take into account the existing physical, programmatic, and fiscal restraints. A zoned protection system should be used, beginning at the site parameter and moving to the interior of the building or the location of the most critical assets. Higher-risk areas are generally those with large concentrations of personnel, such as administration and assembly areas.

2-2.3.1 Topographical Considerations

Elevated sites generally enhance surveillance of the surrounding area, while low-lying areas can increase the effects from biological and chemical weapons.

2-2.3.2 Facility Arrangement

When possible, facilities that are functionally compatible and have similar threat levels should be clustered. This reduces the required perimeter area to be protected, limits access points to serve multiple facilities, and promotes compact security areas. However, the practical benefits of clustering facilities must be balanced against the survivability benefits of resource dispersal in the event of an attack. The arrangement of buildings into complexes that have strongly delineated boundaries and are oriented to enhance the surveillance opportunities creates a “defensible space” that can be protected more efficiently than scattered buildings.

2-2.3.3 Vehicular Access and Circulation

Limiting the opportunities for aggressors to get close to buildings with vehicles is the first line of defense. Ways to achieve the minimum standoff distance from vehicle circulation or parking include creating a buffer zone using design features such as landscape elements and bollards. However, the design must address site access and circulation for fire department apparatus and other emergency vehicles. The site circulation should be designed to prevent high-speed approaches by vehicles. The vehicle entrances should be offset from the major areas of high-risk concentration, and higher-risk resources should be in a location that is remote from primary roads.

2-2.3.4 Site Perimeter Vehicle Inspection

At facilities requiring vehicle inspection or controlled access, the design considerations are as follows:

- Provide space for inspection and waiting in line at the site access point, with adequate protection from inclement weather.
- Incorporate design features that are appropriate with regard to the threat assessment (see paragraph 4-1.2) and prevent vehicles from breaching the perimeter before being inspected.
- Whenever possible, accommodate commercial, service, and delivery vehicles by providing a separate, designated entry that preferably is distant from higher-risk resources.
- Locate driveup or dropoff areas away from large glazed areas of the building to minimize the effects of an explosive blast.

2-2.3.5 Site Lighting

Effective, uniform site lighting levels should be provided at a minimum of 0.50 foot-candle (FC) across the site and supplemented with additional focused lighting at vehicle and pedestrian entrances. Site lighting should be evaluated and designed in accordance with IES-NA. The lighting design should be coordinated with the closed-circuit television (CCTV) system, motion detection (NGB-ARI Delite System) and other means of surveillance to optimize their effectiveness.

2-2.3.6 Site Signage

Confusion over site circulation, parking, and entrance locations can weaken site security. Therefore, signs should be provided to properly orient all who are coming to the site. Signage should include on-site directional information, parking, and cautionary signs for visitors, employees, service vehicles, and pedestrians.

2-2.3.7 Landscaping

Landscaping design can enhance or be a detriment to the security design. Such elements as earth berms and trees can provide barriers, but all landscape features should be carefully designed to coordinate with site surveillance when the plants are fully grown. Landscape plantings can be used to conceal above-ground utility systems, but utilities should be installed underground when possible.

2-2.3.8 Architectural and Engineering Building Systems Design

The specific requirements for AT/FP are described in detail in UFC 4-010-01and UFC 4-023-03, Design of Buildings to Resist Progressive Collapse.

CHAPTER 3

SUSTAINABLE DESIGN AND DEVELOPMENT

3-1 GENERAL INFORMATION

Sustainable Design and Development (SD&D) includes the design, construction, and operation of buildings to reduce negative impacts on the environment, improve the health and comfort of the building occupants, and reduce operating costs while improving building performance. SD&D requires a multi-disciplinary approach that incorporates a wide range of strategies and objectives set in *Executive Orders, EO 13423, Strengthening Federal Environmental, Energy and Transportation Management* into the design and construction process. *The Department of the Army and National Guard Bureau, Installations Division sustainable design and development goal for all projects is a U. S. Green Building Council Leadership in Energy and Environmental Design-New Construction & Major Renovations Version 2.2 (LEED-NC 2.2) Green Building Rating System of Silver. All ARNG MILCON projects will be certified by U S Green Building Council starting with FY09 MILCON projects. States opting to include the SDD/EPACT-05 Line item additional 2% of Primary Facility cost on their DD Form 1390/91 must provide a USGBC Certificate at project close-out.*

3-2 GREEN BUILDING RATING SYSTEM

The design Architect-Engineer should use the Green Building Rating System LEED-NC, developed by the U.S. Green Building Council (USGBC). The LEED-NC rating system is based on compliance with a series of prerequisites and credits to obtain a score within categories of recognition. Five principal categories of sustainable design, which also support other Federal goals in energy and environmental initiatives, have been identified using LEED-NC as a central organizing system:

- Sustainable site design
- Protection and conservation of water
- Design for energy efficiency and consideration of alternative sources of energy
- Optimization of the environmental life cycle of materials
- Enhancement of indoor environmental quality

The following outlines the major objectives and sample strategies for each of these sustainable design categories:

3-2.1 Sustainable Sites

Objectives:

- Promote natural areas.

- Minimize impacts on the site and surroundings.

Sample Strategies:

- Encourage alternative means of transportation.
- Protect from wind and water erosion.
- Use highly reflective paving and roofing materials.
- Use a vegetative roof surface for stormwater management.
- Restore damaged habitat.
- Brownfield Redevelopment (Urban) to conserve greenfields.

3-2.2 Water Efficiency

Objectives:

- Reduce the municipal water supply and treatment burden.
- Allow water to return to the water table.

Sample Strategies:

- Landscape with native plants.
- Use water-efficient, low-flow fixtures.
- Design for rainwater catchment systems.
- Use gray water systems for landscape irrigation.
- Use biological wastewater treatment systems.
- Explore the applications of Waterfree Urinals

3-2.3 Energy & Atmosphere

Objectives:

- Optimize energy efficiency.
- Commissioning Fundamental and Enhanced Building Energy Systems.
- Encourage renewable and alternative energy sources.
- Support international ozone protection protocols.

Sample Strategies:

- Orient the building appropriately.
- Use a highly reflective Energy Star roof.
- Explore Green/Vegetated roof systems
- Specify highly efficient HVAC equipment without the use of chloro-fluorocarbons (CFC) or hydro-chloro-fluorocarbons (HCFC) chemicals.
- Provide occupant controls for all spaces.
- Use photovoltaics and renewable energy sources.

3-2.4 Material & Resources

Objectives:

- Use materials with minimum environmental impact.
- Reduce and manage waste.

Sample Strategies:

- Conduct on-site recycling.
- Implement a construction waste management plan.
- Minimize toxins in materials.
- Specify certified wood and bio-based materials.
- Use biological wastewater treatment systems.
- Specify recycled content.

3-2.5 Indoor Environmental Quality

Objectives:

- Eliminate the sources of indoor pollution.
- Provide for thermal comfort of occupants.
- Provide for occupant connection to outdoors.

Sample Strategies:

- Conduct on-site recycling.
- Limit indoor air pollutants.
- Specify low-emitting materials.
- Incorporate lighting controls.
- Create a natural indoor environment.

3-3 FEDERAL GOALS

3-3.1 Energy Policy

The sustainable design should meet or exceed the efficient energy management goals and objectives stated in Executive Order (EO) 13423. Building energy efficiency goals must meet or exceed ASHRAE Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential Buildings. The Energy Policy Act of 2005 amended 2007 recommends building energy efficiency rating 30% below ASHRAE Standard 90.1-2004.

3-3.2 Environmental Initiatives

The sustainable design must meet or exceed the waste prevention, recycling, and Federal acquisition goals and objectives stated in EO 13101 with guidance in UFC 1-900-01, Selection of methods for the Reduction, Reuse, and Recycling of Demolition Waste and Unified Facilities Guide Specification Sections, UFGS-01355, Environmental Protection; UFGS-01572, Construction and Demolition Waste Management; UFGS-02220, Demolition.

3-3.3 Environmentally Preferred Products

Environmentally preferred products (EPPs) reduce effects on human health and the environment. Products are designated as EPPs after a product assessment based on their raw materials source, production, manufacturing, packaging, distribution, disposal, and recyclability. All selected materials are also required to meet industry standards for durability and cost effectiveness based on an LCCA. The comprehensive guidelines can be obtained at (epa.gov) website.

3-3.4 Facility Equipment

All facility equipment, materials, and operating systems should be based on consideration of the lowest life cycle cost analysis (LCCA) and AR 11-27, the State's energy code, ETL 1110-3-491, and the latest energy and environmental industry standards.

3-4 SPECIFIC APPLICATIONS

3-4.1 General Goals

All facility equipment, materials, and operating systems should be based on the lowest life cycle cost considerations, AR 11-27, the State's energy code, ETL 1110-3-491, and the latest energy and environmental industry standards.

3-4.2 Passive Solar Energy Conservation

The design and orientation of functional areas should in new construction and where feasible in major additions/renovations, make use of the principles of passive solar energy design. Specific passive solar features, however, must be justified on a life cycle cost basis, demonstrating a payback in 20 years or less in order to obtain Federal support. Buildings should be located to best utilize the winter sun day-lighting and warmth, prevailing winds for ventilation, and natural landscape. Refer to *UFC 3-440-03N, Passive Solar Buildings* for design guidance.

3-4.3 Plantings

Landscaping and planting should be integrated appropriately into the design to provide shade from summer sun and to block winter winds. All landscape features should be adequately described for cost estimating proposes. All plant selections must coordinate with all antiterrorism force protection (AT/FP) goals of the site.

Landscaping can reduce direct sun from striking and heating up building surfaces. It can reduce reflected light carrying heat into a building from the ground or other surfaces. The shade created by trees, along with the effect of grass and shrubs can also reduce air temperatures adjoining the building and provide evaporative cooling. The landscape design should also incorporate water conservation principles.

3-4.4 Building Envelope

The building envelope consists of all architectural elements that define the exterior shell of the building. All heated and cooled building roof assembly must have a calculated *U-factor (1/Rt) of 0.025 and wall assembly must be 0.038 Btu/h/SF/F*. Features include the following:

3-4.4.1 Wall and Roof Insulation

The design of the exterior envelope should optimally promote energy-efficient performance guidance in the 2005 Edition ASHRAE Handbook of Fundamentals. In doing this, the design should show that it satisfies the mechanical/HVAC calculations for envelope values submitted at the 35 percent level of design completion.

3-4.4.2 Doors and Windows

Openings should be sized and located to balance energy conservation and the need for natural daylight. High-performance windows with efficient insulated glazing should be considered *(RE: Efficient Windows Collaborative @ www.Efficientwindows.org)* yet carefully matched to the wall thermal performance level based on HVAC heat load calculations for envelope values, including solar gain. Air infiltration should be carefully analyzed and reduced wherever possible.

3-4.4.3 Vestibules

Air locks or vestibules should be provided at the main entrance and at all corridor exits leading to privately owned vehicle (POV) parking if the facility is located in a climatic zone with a design temperature less than 20 °F.

3-4.4.4 Earth Embankments and Berms

Embankments and berms may be used where appropriate, provided such usage does not involve an excessive amount of retaining wall type of construction. Federal support is not authorized for retaining wall construction at the toe of the embankment (for example, where the toe of the berm is above the adjacent finished grade).

3-4.4.5 Weather Stripping and Caulking

Weather stripping and caulking shall be used to reduce air infiltration.

3-4.4.6 Building Configuration and Mass

To reduce heating and cooling costs, the building shape should result in as low an exterior surface and mass as practical and economical.

3-4.4.7 Selection of HVAC Equipment

Interior environmental equipment should be selected based on energy efficiency, including fuel sources. The use of variable air volume (VAV) system, ground source heat-pump systems, in-floor radiant heating and central heating/cooling plants for multiple facilities must meet the lowest life cycle cost for owning and operating.

3-4.4.8 Standard HVAC System Features

Standard HVAC system features to provide, at a minimum, are as follows:

- A Utility Monitoring and Control System (UMCS) per UFGS-13801) or programmable timer with the capability to preset the appropriate temperature level for occupied and unoccupied usage of the various zones.
- Provide Digital Utility Metering at all buildings for water, natural gas, and electric in accordance with the Energy Policy Act of 2005 and DOE/EE - 0312 Guidance for Electric Metering in Federal Building (www.eere.energy.gov/femp).
- A temperature sensor to automatically shut off the heating system when the outside temperature reaches 65 °F
- Door closers, where justified, on exterior and interior doors
- Operable (manual) windows
- Low-leakage dampers

3-4.4.9 Optional System Features

HVAC system features to consider, if economical, include the following:

- Multiple boilers
- Destratification fans in assembly halls

- Exhaust hoods that supply 80% untempered makeup air through an outer jacket of the kitchen exhaust hood (to exhaust only a limited amount of heated room air)

3-4.4.10 **Domestic Hot Water**

Domestic hot water heating plants should use natural gas, electric and supplemental solar panels where feasible. Other features should provide the following:

- Flow restrictors in shower heads
- Low-flow aerators in kitchen and lavatory faucets
- Separate water heaters for kitchen and small toilet areas serving full-time occupancy
- Outdoor temperature reset control for the water-heating systems may vary water temperature inversely with outdoor temperature.
- Solar water heating panels should be used where economically feasible.

CHAPTER 4

COMMON FUNCTIONAL SITE DESIGN GUIDELINES

4-1 SITE ANALYSIS EVALUATION

4-1.1 Site/Area Suitable for Building Construction

The geotechnical investigation, the facility master plan development, and the conceptual-level site analysis process with regard to sustainable site goals should provide information clearly delineating the extent of the site area that is suitable for building construction in the initial phase of development and potential future expansion.

4-1.2 Compliance with Threat Assessment Criteria

All building complex designs should clearly indicate, to scale, the configurations of the exclusive and nonexclusive standoff perimeters on designated site plan drawings. Areas of potential building expansion should be considered when establishing standoff perimeters.

4-1.3 Urban Brownfield Redevelopment Site Selection

Select Urban Brownfield sites early in the master planning and site selection process for MILCON projects in the State/Adjutant Generals Long-Range Construction Plan (LRCP) to allow time for remediation. The U. S. Environmental Protection Agency (EPA) supports the States Brownfield and Voluntary Response Programs and their Voluntary Cleanup Programs (VCP) that promote cleanup and reuse. To review each State VCP reference EPA Brownfield State and Voluntary Response Programs at (www.epa.gov/cgi-bin/epaprintonly.cgi).

4-2 STORMWATER POLLUTION PREVENTION

4-2.1 Stormwater Management Practices

The best management practices currently used in stormwater quality control includes wet and dry ponds, infiltration trenches, porous paving, and oil-grit separators. These practices have certain limitations and drawbacks. Therefore, the design A-E should carefully analyze their functional benefit and cost impact before incorporating them into the project.

Design goals are to minimize stormwater runoff by maximizing the infiltration of rainwater into groundwater and to reduce the concentration of undesirable chemicals in both groundwater and surface waters. The key to these efforts is to minimize the nonporous surface areas, which is consistent with sustainable goals for reducing the heat sink effect on site.

4-2.2 Bioretention Ponds

Bioretention ponds may be used at most ARNG facilities. These small, inexpensive, and somewhat isolated improvements combine the absence of paving (which allows ponding and eventual infiltration of water) with the uptake and chemical conversion of

some pollutants by bacteria adsorbed onto the roots of selected plant species. Often, these bacteria are the best method to reduce the concentration of nitrogenous chemical species and phosphates in surface water.

4-2.2.1 Standard Reference for Small Watersheds

The standard reference, TR-55, Urban Hydrology for Small Watersheds, contains technical calculations for bioretention ponds. TR-55 serves to determine the amount of storage required to mitigate the impact of urbanization, including parking lots.

4-3 REQUIRED PAVED AREAS

Three Army National Guard facilities require large expanses of paved areas:

- Mobilization and training equipment sites (MATES)
- Combined support maintenance shops (CSMS)
- Army aviation support facilities (AASF)

Rigid concrete pavement is authorized for all parking surfaces. However one option is to maximize the use of crushed stone or hardstand in lieu of pavement at maintenance facilities for ground vehicles. This material permits rainwater infiltration and recharge into the groundwater. Its usefulness decreases to the extent that the ground is compacted prior to emplacement, because the compacting reduces porosity and therefore permeability to rainwater. At AASF facilities, however, crushed stone is not an option, given the justified concern over rotor and prop wash kicking small particulates such as stones or dust into aircraft engines. For AASF Aircraft parking a resin modified pavement surfacing material maybe specified (UF-02746)

4-4 FUEL STORAGE AND DISPENSING SYSTEM

Any fuel storage or dispensing facility must be designed in accordance with guidance in MIL-HDBK-1022A and with the State's Department of Environmental Quality, EPA, and local regulations. Fuel storage may be either above or below ground. Above-ground storage tanks should be concrete encased. Placement of tanks in proximity to buildings should take into account fire protection codes, including NFPA 30, or should be fire-rate tanks accordingly. Fuel-dispensing units for the direct fueling of ground vehicles should be in accordance with standard MIL-848-2 and should have an output capacity no greater than 26 gpm. The pump should be located in the dispensing unit rather than the dispensing tank. Special approval is required for high-speed, large-capacity units involving multiple dispensing systems and a pump located in the tank. The pump should be located in the dispensing unit rather than in the dispensing tank. In addition to fueling individual vehicles, the system must be equipped for bottom-loading tank trucks and trailers. The system should meet all Federal, State, and environmental regulatory requirements.

In accordance with AR 70-2, all plans for new construction, modification, or upgrading of petroleum facilities containing fuel purchased with Federal funds must be submitted prior to bidding for review and technical assistance to:

U.S. ARMY PETROLEUM CENTER (APC)
Facilities and Operations Division
8725 John J. Kingman Road, Stop 6421
Fort Belvoir, VA 22060-6241

Questions related to fuel-dispensing systems can be answered by calling the APC at:

- (703) 767-0646 or DSN 427-0646
- (703) 767-0648 or DSN 427-0648

4-5 CONTROLLED WASTE-HANDLING FACILITY

The controlled waste-handling facility should be a separate building constructed of noncombustible materials. It should be in close proximity with flammable/combustible storage and bulk POL storage. As a hazard, it should be located at the appropriate distance from other buildings in accordance with fire safety and building codes applicable for the State, such as NFPA 30 and the IBC. The facility should be within a secured compound and located to minimize the impact of contamination by accidental surface runoff. A prefabricated structure may be used. A 6-ft-high chain link fence or permanent partition should be designed within the enclosure to separate the various types of controlled waste. The latest Federal and State environmental agency waste management requirements for controlling waste should be followed.

A single-point grounding system shall be used to ground flammable materials in metal containers. It should be wired in series to the ground point, with an anchor bolt installed in the concrete floor for each separate, segregated area within the enclosure. Fire protection systems, explosion relief construction, air conditioning, and heating are not authorized unless required by the type of waste stored. Adequate ventilation should be provided at the edge of the concrete slab and the walls to prevent spontaneous combustion of escape fumes from material storage containers. If the roof is flat or nearly flat, a continuous ridge vent or other roof-top ventilation should be provided.

The controlled waste-handling facility should have one personnel door, one 6-ft-wide by 10-ft-high overhead coiling door for forklifts, and one 6-ft-wide by 8-ft-high overhead coiling door for non-forklift operations. The floor should be constructed of reinforced concrete and must have a chemical and moisture-resistant seal (such as an epoxy-based system) with liquid-tight, chemical-resistant joint sealants at any floor joints. It should have a spill/leak containment raised edge. The slab reinforcement design must resist cracking to prevent leaks in the floor containment membrane and to support the loads from stored materials. The design A-E must comply with environmental regulations regarding containment sump capacity.

4-6 COVERED (ENCLOSED), UNHEATED VEHICLE AND PARTS STORAGE

Covered, unheated vehicle storage and parts spaces should be sized according to the program documents. The facility should have one personnel door, one 6-ft-wide by 10-ft-high overhead coiling door for forklifts, and at least one overhead coiling door for vehicular operations, with additional vehicle doors as the size of the facility dictates.

Doors must be sized for vehicle access according to vehicle clearance requirements, and protection for door edges should be provided.

4-7 COVERED STORAGE AREA

Covered storage areas should be sized according to the program documents. Vertical maneuvering clearance should be 14 ft clear height, measured at the one-third point of the underside of the lowest sloping roof structural elements. The covered area may be enclosed when indicated in the program documents. The design should incorporate a super-flat reinforced concrete slab suitable for high-stack forklift traffic and load support.

4-8 WASH PLATFORMS FOR VEHICLES/EQUIPMENT

Wash platform sizes depend on the type of vehicles to be washed. Generally, the minimum standard-sized platform is 25 ft by 40 ft. Wash platforms should be equipped with settling basins prior to discharge to trap grit, and with an oil and grease interceptor in accordance with all environmental requirements in Federal, State, and local codes. The water supply should be sufficient to provide a flow of 40 gpm at 40 psi at each hydrant.

4-9 BULK POL STORAGE

Consolidated above-ground, liquid bulk storage of new petroleum, oils and lubricants generally requires temperature and ventilation control. It should be next to the Controlled Waste Handling areas and close to the Flammable/Combustible Storage area; but isolated from all other shops and storage rooms.

4-10 FLAMMABLE MATERIALS STORAGE

Consolidated storage of bulk solid flammable materials (not fuels). It is generally unheated, and requires ventilation. It should be next to the Controlled Waste Handling areas and close to Bulk POL Storage, but isolated from other shops and storage rooms.

The flammable materials storage (FMS) building may be a separate prefabricated metal building or constructed of concrete masonry units (CMU) or the same material as the main building as long as the design meets all Federal, State, and local codes, regulations, and ordinances. If designed as part of the main building, the FMS should have an exterior door and may have an interior automatic self-closing noncombustible fire door, and the entire storage area must be surrounded by a liquid-tight 4 in. high curb. A roof- or wall-mounted exhaust fan and a wall or door louver near the floor should be provided to prevent hazardous vapor from accumulating within the area. If the FMS is located in a separate building it is generally not heated and is considered a Class 1, Division 1 hazardous location for electrical work. The net floor area can be obtained from the approved program documents. The FMS may be equipped with metal shelves. No floor drain is to be provided. If the interior area is to be separated for item or organizational control, an industrial wire mesh partition may be provided.

CHAPTER 5

COMMON FUNCTIONAL PLANNING AND BUILDING DESIGN GUIDELINES

5-1 FUNCTIONAL PLANNING RELATIONSHIPS

All functional site and building design components should respect fundamental planning relationships that optimize efficient operations at Army National Guard facilities.

Each facility-type design guide, used in combination with this document, includes specific information related to the topics discussed in the following paragraphs.

5-1.1 Proximity

All program functions listed in NG PAM 415-12 for each facility type have priorities of functional proximity to one another. Some should be adjacent because of functional co-dependence, and others isolated because of incompatibility.

Each facility-type design guide includes adjacency matrices related to all functions to be located in the facility. In addition, functional relationship diagrams, which delineate each function in proportional scale, are included to assist the design A-E. These diagrams are not intended to establish conceptual design direction but to assist in the functional comprehension process.

5-1.2 Expandability

The location of those functions with the greatest potential for future expansion warrants careful consideration. Such functions should be placed either at the building perimeter, allowing incremental growth in a new addition, or adjacent to flexible use areas that can be converted into additional dedicated functional space. Facility expansion should be considered in establishing AT/FP standoff zones. All designs should accommodate 25% expansion without affecting the initial AT/FP standoff zones.

5-1.3 Special Environmental Requirements

Unique space environmental factors to consider during the space planning process include:

- Height requirements
- Noise and vibration isolation
- Requirements for utility support
- Public versus secure spaces
- Code-required fire separations

5-1.4 Access to Natural Light

The location of classrooms and open administrative areas should maximize exposure to natural light.

5-1.5 Service Efficiency

Common service functions, including toilet facilities and mechanical and electrical rooms should be grouped horizontally and vertically. The design should provide adequate space for servicing and replacing mechanical and electrical equipment. Where possible in new construction and major renovation locate mechanical/electrical rooms on outside walls to allow unrestricted equipment service and replacement activities.

5-2 GENERAL BUILDING CIRCULATION

The circulation area authorization in the program documents is for interfunctional use only. The individual functional space allowances include intrafunctional circulation. The designer should layout the building spaces in the most efficient manner with the smallest ratio of circulation space/occupied space.

5-2.1 Direct Routes

Circulation areas should provide direct access to functional spaces without the use of offsets or elaborate circulation patterns.

5-2.2 Corridor Width

Corridor width should be based on the anticipated use but should not exceed 6 ft, unless required by the calculated exit width as determined by building codes (or NFPA 101). The minimum clear width is governed by means of egress sections of these codes.

5-2.3 Lobby Requirements

The building should have only one lobby that is easily observed from the adjacent functions.

5-2.4 Vertical Circulation

Stairways should be strategically located adjacent to corridors. Elevators are authorized for all two-story facilities to allow access and freight handling between floors. Stair placement must be evaluated as part of the means of egress travel distance limits, dead-end limitations, and exit discharge requirements in the codes.

5-3 APPROPRIATE BUILDING MATERIALS

The Army National Guard has extensive experience resulting in lessons learned relative to the durability of both interior and exterior building materials. Exterior building materials should comply with the performance guidelines presented in Chapter 6, Common Architecture and Engineering Technical Guidelines. Each facility-specific design guide contains tables of generic architectural interior finish materials. These represent performance level expectations; alternatives with the same characteristics may be considered for use.

5-4 HVAC, ELECTRICAL, AND TELECOMMUNICATIONS SYSTEMS

During the entire development of the building design, it is important to maintain a focus on the design intent related to fundamental environmental, electrical, and communications systems. Emphasis should be on indoor air quality, energy, efficiency, flexibility of needs, and adaptability for future technological advancement. The size of the mechanical, electrical, and telecommunication room(s) depends on the geographic

location as well as the amount and size of the actual equipment needed to provide the heating, ventilation, and air conditioning (HVAC), electrical, and telecommunications support for the entire building. The floor plan layout, drawn to scale and showing the required equipment, should justify the actual floor space required. The building mechanical, electrical, and telecommunications equipment should be housed in separate rooms with direct outside access where possible. The telecommunications room should be environmentally controlled to protect the equipment from overheating.

5-5 FACILITY MAINTENANCE AND CUSTODIAL AREA

The facility maintenance and custodial area should be located on an outside wall to allow direct access for taking equipment and supplies in and out for maintenance and upkeep. The design may include wood or metal shelving attached to the floor and installed along one wall. One custodial room may be provided per floor. Each should have one mop sink, shelving on the wall, and a wall-mounted broom and mop rack.

5-6 REGIONAL CONSIDERATIONS

ARNG facilities are constructed in very diverse climates. The design A-E must research the proposed materials and systems in detail to verify their appropriateness, particularly related to the building envelope. Consideration should include durability to the elements and availabilities, particularly in remote locations. Reference *UFC 3-440-05N, Tropical Engineering* for ARNG Tropical Regions for (Southern Florida, Hawaii, Guam, Virgin Islands and Puerto Rica) planning, design and construction. Reference UFC 3-130-07 Arctic and Subarctic Construction for Buildings for ARNG Cold Regions facilities.

5-6.1 Mechanical Systems

In tropical and semi-tropical climates, mechanical cooling should be considered in storage areas as well as occupied portions of the building. Regions that experience long periods of high humidity may require dehumidification, not only for human comfort but also to avoid damage to stored equipment and supplies. Analysis should be performed before airside economizers are selected, as they are frequently not cost effective in hot, humid climates. Intense sun may justify external sun shades on windows. Mechanical system protection from tropical storms should be considered.

In extremely cold climates, heating is required in almost all building areas. Special attention must be given to the potential freezing of pipes located in outside walls, stairways, or any unoccupied area. Outside air intakes and exhaust outlets must be protected from snow accumulation. Intakes ducts and coils must be designed to avoid ice accumulation and to dispose of water resulting from melting ice. Glycol solution should be used in preheat coils to avoid coil freezeup, and special care must be exercised to ensure proper mixing of outside and return air at AHU inlets. Some form of perimeter heating, such as baseboard radiation, should be considered. Standby boilers, pumps, and other equipment should be provided to prevent building freezeup in the event of major equipment failure.

5-6.2 Architectural Considerations

Observation and recognition of the reasons for certain materials being favored locally assists the design A-E in evaluating materials that are intended to reflect this knowledge. The design A-E is encouraged to adopt the same practical approach to

selecting materials that reflect the community environment. The design A-E is cautioned to avoid introducing materials inappropriate to a climatic region.

The following are some examples of impacts on design resulting from environmental and climatic extremes:

- Ground moisture content, which may have an impact on slab design and elements below grade
- Dew point/condensation management in extremely cold climates or in spaces that change from conditioned to unconditioned based on use (and thermal breaks in insulated window units to prevent condensation/frost in cold climates)
- The position and type of the air retarder, vapor retarder, waterproofing, and damproofing in exterior walls and roofs in climatic extremes
- Perimeter below-grade insulation in extremely cold climates
- Piled (plowed) snow and ice against the perimeter of the building, and de-icing chemicals and water/slush ice tracked inside
- Fenestration and other shading considerations in very hot climates
- Alkaline content of soils, which may have an impact on concrete and reinforcement
- The effect of extreme temperature differentials on movement isolation and movement control joints, particularly masonry
- Drifting snow against edges of the building in cold climates, along with snow loads on the roof related to structural design

5-6.3 Areas of Seismic Extremes

Structural engineering design requirements for areas of seismic extremes are provided in the International Building Code, Structural Design and UFC 3-310-03A Seismic Design for Buildings. In addition, the design A-E should ensure that ceilings and ceiling-hung/structurally supported elements are braced, particularly in assembly areas, and that elevator hoistways have proper tolerances.

5-6.4 Areas of Wind Extremes

In areas subject to extreme wind conditions, structural design should be based on the most stringent requirements of the IBC or local building codes and regulations. The design A-E should consider persistent wind effects in cold climates on door entries, door closer operation, and glazing unit design.

5-7 COMMON FACILITY FUNCTIONAL AREAS

The following functions have the same design guidance for inclusion in all facility types.

5-7.1 Break Room (Area)

The break room space should be conveniently located for the majority of the building occupants and contain a vending area. The location needs to be acoustically isolated or remote from areas needing a quiet environment. It should include vending machines plus tables and chairs in the amount appropriate to the size of the facility.

5-7.2 Toilets and Showers

The approved program documents should indicate the number of designated males and females in order to proportion the authorized space appropriately. The appropriate plumbing code should be used to determine the specific number of each type of plumbing fixtures.

5-7.3 Physical Fitness Area

The physical fitness area is used on a daily or weekly basis for physical training and requires construction to withstand the impact of furnished exercise equipment. The area should be located at an appropriate distance from administrative and classroom functions for acoustical reasons. The physical fitness machines and equipment are classified as portable equipment to be purchased through standard supply channels, not with Federal construction funds.

5-7.4 Mail Room

Mail room is a facility operated by or for the National Guard/Department of Defense (DOD) for the receipt and delivery of mail for military units or other authorized organizations and agencies by entities outside the National Guard/DoD. This does not include mail rooms that receive mail distribution that was initially received at a central DOD mail handling facility.

Mail rooms in inhabited facilities should comply with the minimum design standards as addressed in the Unified Facility Criteria (UFC) 4-0101-01. The following are some of the minimum anti-terrorism design standards for mail rooms addressed in the UFC 4-010-01:

- Locate mail rooms on the perimeter of the building.
- Locate mail rooms as far from heavily populated areas of the building and critical infrastructure as possible.
- Ensure that mail rooms are well sealed between their envelopes and other portions of the buildings in which they are located to limit migration into buildings of airborne chemical, biological, and radiological agents introduced into mail rooms.
- Provide separate, dedicated air ventilation systems for mailrooms to ensure airborne chemical, biological, and radiological agents introduced into mailrooms do not migrate into other areas of buildings in which the mailrooms are located.
- Provide dedicated exhaust systems within mailrooms to maintain slight negative air pressures with respect to the remainder of the buildings in which the mailrooms are located so that the flow of air is into and contained in the mailrooms.

CHAPTER 6

SUPPLEMENTAL SUBMISSION REQUIREMENTS

(To be determined and developed As Required)

CHAPTER 7

FUNCTIONAL QUALITY ASSURANCE

7-1 MILESTONE COMPLIANCE ASSURANCE

To verify that all functional and performance goals are being accomplished in the project development process, the design review directives checklists in Appendix C should be used in the review exercise performed at the 10 percent, 35 percent, and 95 percent design and documentation submission milestones for each facility type (refer to the facility-type design guide for additional, unique design review directives). These reviews are not intended to be an all-inclusive technical analysis related to design criteria. That responsibility belongs to the State and should be accomplished prior to submission of the documents to NGB-ARI at the milestones. The main focus of the NGB-ARI review shall be on effective incorporation of functional requirements that are both general and unique to the different types of facilities.

7-2 DESIGN REVIEW DIRECTIVES FORMAT

The design review directives are arranged to address the following:

- General project coordination issues
- General issues pertaining to each discipline
- Specific functional issues pertaining to each discipline

Many of the checklist items refer directly to the related technical guidance information in Chapter 6, Common Architecture and Engineering Technical Guidelines, by indication in the left margin. Others make reference to SPiRiT/LEED-NC compliance and related industry standards.

7-3 REVIEW TASKS

Each review task is written in the form of a directive. This format describes the task to be accomplished to ensure compliance with the functional design intent and adequacy of the information related to the requirements of the milestone submission.

APPENDIX A

REFERENCES

The following lists criteria in the form of regulations and industry standards to use in designing ARNG facilities in addition to the references listed in the facility-type design guides. The design A-E should use the current applicable edition of all references.

GOVERNMENT PUBLICATIONS:

1. Executive Office	EO 13101, Greening the Government Through Waste Prevention, Recycling, and Federal Acquisition.
	EO 13123, Greening the Government Through Efficient Energy Management.
2. U.S. Army Corps of Engineers (USACE)	ETL 1110-1-177, Use of Resin modified Pavement.
	DG 1110-3-122, Design Guide for Interiors.
	FORSCOM Access Control Points
	ETL 1110-3-481, Containment and Disposal AFFF Solution.
	ETL 1110-3-484, Aircraft Hangar Fire Protection Systems.
	ETL 1110-3-485, Fire Protection for Helicopter Hangars.
	ETL 1110-3-491, Sustainable Design for Military Facilities.
	General Instruction Building and Army Continuing Education System Standard Design Criteria.
	UFC 3-600-01, Fire Protection for Facilities Engineering, Design, and Construction.
	TI 810-90, Technical Instructions – Elevator Systems. Technical Instructions – Structural Design

	Criteria for Buildings. TI 800-01, Design Criteria. TI 809-04, Seismic Design for Buildings. TI 810-90, Elevator Systems. Training Centers – ARNG/USAR Facilities Standards Booklet.
3. U.S. Green Building Council	USGBC Green Building Rating System LEED-NC
4. Army National Guard (ARNG)	NGR 415-5, Army National Guard Military Construction Program Development and Execution. NGR (AR) 415-10, Army National Guard Facilities Construction. NG PAM 415-12, Army National Guard Facilities Allowances. NGR 5-3, Army National Guard Training Centers (Management).
5. U.S. Department of Agriculture, Natural Resources Conservation Service (formerly the Soil Conservation Service)	TR-55, Urban Hydrology for Small Watersheds. http://www.wcc.nrcs.usda.gov/water/quality/cost.html
6. Department of the Army	AR 11-27, Army Energy Program. AR 190-11, Physical Security of Arms, Ammunition and Explosives. AR 190-13, The Army Physical Security Program. AR 190-51, Security of Unclassified Army Property (Sensitive and Nonsensitive), Appendix D. AR 415-15, Army Military Construction Program Development and Execution. AR 420-49, Utility Services.

	Army Regulation (AR) 425-15.
	DA Form 2028, Recommended Changes to Publications and Blank Forms.
	DA PAM 190-51, Risk Analysis for Army Property.
	TM 5-853-1, Security Engineering Project Development.
	TM 5-853-2, Security Engineering Concept Design.
7. Department of Defense (DoD)	MIL-HDBK-1022A, Petroleum Fuel Facilities.
	UFC 1-200-01, Design: General Building Requirements.
	UFC 3-600-01, Fire Protection Engineering for Facilities.
	UFC 4-010-01, DoD Minimum Antiterrorism Standards for Buildings.
	UFC 3-400-01, Design: Energy Conservation.
	UFC 3-410-01FA, Design: Heating, Ventilating, and Air Conditioning.
	UFC 3-400-02, Engineering Weather Data
	UFC 3-440-03N, Passive Solar Buildings
	UFC 3-440-05N, Tropical Engineering
	UFC 3-520-01, Electric Design Interior Electrical System.
	UFC 3-570-06, O&M Cathodic Protection Systems.
	UFC 3-580-02, Telecommunications Systems Inside Plant Planning and Design. UFC 4-023-03, Design of Buildings to Resist Progressive Collapse

8. Department of Energy, Federal Energy Management Program (FEMP)	Business Case for Sustainable Design in Federal Facilities.
9. U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health (NIOSH)	Publication No. 2002-139, Guidance for Protecting Building Environments from Airborne Chemical, Biological, or Radiological Attacks.
10. U.S. Department of Labor, Occupational Safety & Health Administration (OSHA)	29 CFR Part 1910, Occupational Safety and Health Standards. OSHA Standards for General Industry, Walking – Working Surfaces, 1910.21–1910.23. Fall Protection in General Industry, 29 CFR 1910.
11. Uniform Federal Accessibility Standards (UFAS)	Handbooks and standards.
12. Department of Energy (DOE)	FEMP (Business Case for Sustainable Design Construction in Facilities; Interagency Working Group).
13. U.S. Environmental Protection Agency (EPA)	Comprehensive Procurement Guidelines, www.epa.gov EPA 832-R-92-005, Stormwater Management for Construction Activities**:** Developing Pollution Prevention Plans and Best Management Practices. 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST) and Part 281, Approval of State Underground Storage Tank Programs.
14. U.S. Department of the Navy	TM 6290.99-1, Indoor Firing Range Industrial Hygiene Technical Guide. UG-2030-SUR, User's Guide on Security Glazing Applications. TR-2111-SHR, Planning and Design Considerations for Incorporating Blast Mitigation in Mailrooms, Loading Docks, and

	Entrances. TDS-2079-SHR, Planning and Design Considerations for Incorporating Blast Mitigation in Mailrooms.
15. Architectural and Transportation Barriers Compliance Board	36, CFR, Parts 1190 and 1191, Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines Americans with Disabilities Act (ADA), 42 U.S.C. Sec. 12101 et seq. Public Law 90-480, Architectural Barriers Act of 1968.
16. ------	Federal Specification AA-D-600B, Door, Vault, Security.
17. ------	Specification FF-H-105.
18. ------	Title 10 U.S.C., Armed Forces.

NON-GOVERNMENT INDUSTRY STANDARD PUBLICATIONS:

1. American Concrete Institute (ACI) American Society of Mechanical Engineers (ASCE), and The Masonry Society (TMS)	ACI 530/ASCE 5/TMS 402-92, Building Code Requirements for Masonry Structures and Commentary. ACI 318-02, Building Code Requirements for Structural Concrete and Commentary.
2. Air Conditioning and Refrigeration Institute	Standards.
3. American Institute of Steel Construction (AISC)	Specification for Structural Steel Buildings (Allowable Stress Design and Plastic Design). Load and Resistance Factor Design (LRFD) Specification for Structural Steel Buildings.
4. American Boiler Manufacturers Association (ABMA)	Handbooks and standards.

5. American Iron and Steel Institute (AISI)	North American Specification for the Design of Cold-Formed Steel Structural Members and Commentary. Standard for Cold-Formed Steel Framing – Truss Design.
6. American Conference of Governmental Industrial Hygienists (ACGIH)	Industrial Ventilation Manual.
7. American Institute of Architects (AIA)	Handbooks and standards.
8. American National Standards Institute (ANSI)	ANSI A115.1, Steel Door and Steel Frame Preparation for Mortise Locks for 1-3/8 In and 1-3/4 In Doors Standard Specification. ANSI A120.1, Safety Requirements for Powered Platforms for Building Maintenance. ANSI B31, Code for Pressure Piping. ANSI/ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality.
American National Standards Institute/ Builders Hardware Manufacturers Association (ANSI/BHMA)	Handbooks and standards.
9. American Petroleum Institute	Standards.
10. American Society for Testing of Materials (ASTM)	ASTM D2513, Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
11. American Society of Civil Engineers (ASCE)	Handbooks and standards.

12. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)	Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential Buildings. Standard 62.1-2004: Ventilation for Acceptable Indoor Air Quality Standard 55-2004: Thermal Environmental Conditions for Human Occupancy Handbooks of: Fundamentals; HVAC Applications; HVAC Systems and Equipment; Refrigeration
13. American Society of Mechanical Engineers (ASME)	Boiler and Pressure Vessel Code.
14. American Society of Plumbing Engineers (ASPE)	Handbooks and standards.
15. Associated Air Balance Council (AABC)	Handbooks and standards.
16. Consumer Product Safety Commission (CPSC)	Window Glazing Standard
17. Illuminating Engineering Society of North America (IESNA)	Lighting Standards.
18. Institute of Electrical and Electronic Engineers (IEEE)	Handbooks and standards.
19. International Code Council (ICC)	International Building Code. International Mechanical Code. International Plumbing Code.
20. International Conference of Building Officials (ICBO)	Uniform Building Code.
21. International Fuel Gas Council	International Fuel Gas Code (IFGC). Handbooks and standards.
22. Manufacturers Standardization Society (MSS)	SP-58, SP-69, SP-89, Pipe Hangers and Supports.
23. Midwest Insulation Contractors Association (MICA)	National Commercial & Industrial Insulation Standards.

24. National Fire Protection Association (NFPA)	National Fire Protection Handbooks. NFPA 10, Fire Extinguishers. NFPA 13, Installation of Sprinkler Systems. NFPA 30, Flammable and Combustible Liquids Code. NFPA 70, National Electric Code. NFPA 72, National Fire Alarm Code. NFPA 78, Lightning Protection Code. NFPA 90A-02/90 B-02, Installation of Air Conditioning, Ventilation and Warm Air Heating Systems. NFPA 101, Life Safety Code.
25. National Roofing Contractors Association (NRCA)	Roofing and Waterproofing Manual (http://www.nrca.net/technical/manual/default.asp
26. International Plumbing Code	Building Code
27. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)	Handbooks and standards (duct construction).

28. Steel Deck Institute (SDI)	Specifications and Commentary.
	Diaphragm Design Manual.
29. Steel Joist Institute (SJI)	Standard Specification and Load Tables.
30. Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)	568A Standard.
31. U.S. Green Building Council	Leadership in Energy and Environmental Design (LEED™) Building Rating System.

APPENDIX B

GLOSSARY

B-1 ACRONYMS AND ABBREVIATIONS

AABC	Associated Air Balance Council
AASF	Army Aviation Support Facilities
ABA	Architectural Barriers Act
ABMA	American Boiler Manufacturers Association
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines
A-E	Architect-Engineer
AFFF	Aqueous Film Forming Foam
AHU	Air Handling Unit
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
AR	Department of Army Regulation
ARNG	Army National Guard
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing and Materials
AT/FP	antiterrorism/force protection
AWI	Architectural Woodwork Institute

BHMA	Builders Hardware Manufacturers Association
Btu	British thermal unit(s)
CBR	California bearing ratio
CCTV	closed-circuit television
CFC	chloro-fluorocarbons
CFMO	construction and facilities management officer
CFR	Code of Federal Regulations
CPSC	Consumer Product Safety Commission
CSI	Construction Specifications Institute
CSMS	Combined Support Maintenance Shops
DA	Department of the Army
DG	Design Guide
DoD	(U.S.) Department of Defense
DOE	(U.S.) Department of Energy
DOIM	Director of Information Management
DWV	drain, waste, or vent
DX	direct expansion
EBU	emergency battery unit
EIA	Electronic Industries Alliance
EO	Executive Order
EPA	(U.S.) Environmental Protection Agency
EPDM	ethylene propylene diene monomer
EPP	environmentally preferred product
ETL	Engineer Technical Letter
F	Fahrenheit
FC	foot-candle(s)
FEMP	Federal Energy Management Program
ft	foot or feet
FTP	file transfer protocol
gpm	gallons per minute
HCFC	hydro-chloro-fluorocarbons
hr	hour(s)

HVAC	heating, ventilation, and air conditioning
IAQ	indoor air quality
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronic Engineers
IEQ	indoor environmental quality
IESNA	Illuminating Engineering Society of North America
IFGC	International Fuel Gas Code
IMA	(U.S. Army) Installation Management Agency
in.	inch(es)
J-SIIDS	Joint Services Interior Intrusion Detection System
lb	pound(s)
LCCA	life cycle cost analysis
LED	light-emitting diode
LF	linear foot/feet
LPG	liquefied petroleum gas
MATES	mobilization and training equipment sites
MICA	Midwest Insulation Contractors Association
MILCON	military construction
MIL-HDBK	Military Handbook
MSS	Manufacturers Standardization Society
NCRA	National Roofing Contractors Association
NEC	National Electrical Code
NFPA	National Fire Protection Association
NGB-ARI	National Guard Bureau, Installations Division
NG PAM	(Army) National Guard Pamphlet
NGR	National Guard Regulation
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NRCA	National Roofing Contractors Association
OSHA	Occupational Safety & Health Administration

PAM	Pamphlet
POL	petroleum, oils, and lubricants
POV	privately owned vehicle
PPE	personal protective equipment
psi	pounds per square inch
PVC	polyvinyl chloride
RCAS	Read Clear All Scalers
RH	relative humidity
SDI	Steel Deck Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPiRiT	Sustainable Project Rating Tool
SWPPP	stormwater pollution prevention plan
TI	Technical Instruction
TIA	Telecommunications Industry Association
TM	Technical Manual
TMS	The Masonry Society
TR	Technical Release
UBC	Uniform Building Code
UFAS	Uniform Federal Accessibility Standards
UFC	Unified Facilities Criteria
UL	Underwriters Laboratories
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USPFO	U.S. Property and Fiscal Office
UST	underground storage tank
VE	value engineering
VOC	volatile organic compound
yd	yard(s)

B-2 SPECIALIZED TERMS

exclusive standoff zone	the controlled area surrounding a structure, into which only service and delivery vehicles are allowed
level of protection	the degree to which assets are protected against injury or damage from an attack by an aggressor
Life Cycle Cost Analysis (LCCA)	a systematic means of evaluating the building energy and conditioned space systems for practicality by measuring initial cost against beneficial use over an extended period of time
nonexclusive standoff zone	the controlled area that is used in conjunction with an exclusive standoff zone but provides less restrictive land use
SPiRiT	Sustainable Project Rating Tool. A Sustainable Design and Development self-assessing system designed to help achieve facilities that meet the needs of current missions and accommodate future missions in a sustainable cost-effective, environmentally friendly manner.

APPENDIX C

DESIGN REVIEW CHECKLISTS

Table 6-1. Design Review Directives

	GENERAL COORDINATION ISSUES	SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
	SITE DEVELOPMENT			
	A complete site survey report has been provided.			
1-3.20	Soil Bearing Capacity Declaration and Declaration of Uniformity of Soil Conditions (if applicable) have been provided for the current development and areas of future expansion.			
4-2.0	Storm water permit and pollution prevention plan have been obtained/approved.			
	ARNG Environmental Checklist and Record of Consideration have been reviewed, and a record is included in the narrative.			
	An Environmental Impact Statement has been completed and approved by the governing agencies.			
	FUEL-DISPENSING SYSTEMS			
	Size of concrete pad and slab design comply with standards.			
	Utility connections meet capacity required based on check of criteria.			
	Spill containment provisions are adequate to meet requirements.			
	Capacity of fuel tanks meets authorized requirement.			
	WASH PLATFORM			
4-8.0	Size of concrete pad and slab design comply with standards.			
	Water drainage and effluent disposal meet environmental requirements.			
	Water service is adequate based on check of calculations.			
	MAINTENANCE			
	Vehicular maintenance areas and equipment comply with environmental criteria and OSHA requirements.			

Table 6-1. Design Review Directives

GENERAL COORDINATION ISSUES	SUBMISSION		
	CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
1-3.17.1 Safety provisions for the building equipment maintenance area comply with OSHA requirements, including roof perimeter restraints when rooftop equipment is part of the mechanical, electrical, and communications systems.			
Site and building construction materials and details meet the project specific levels of antiterrorism and force protection.			

Table 6-1. Design Review Directives

ACCESSIBILITY REQUIREMENTS		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
1-3.7	The site and building design comply with accessibility requirements for the following conditions based on check of the plans and the narrative.			
	Path of travel to the building, including drop-off areas		■	■
	Building entrances including doors and vestibules		■	■
	Horizontal circulation throughout the building, excluding maintenance areas		■	■
	Emergency egress routes			■
	Toilet, shower, and locker facilities		■	■
	Drinking fountains			■
	Public telephones			■

Table 6-1. Design Review Directives

SITE AND CIVIL ENGINEERING	SUBMISSION		
	CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SITE / CIVIL - SUPPORTING DOCUMENTATION			
Based on review, the site survey information includes all exisitng vegetation, topography, floodplains, rights-of-way, and utility connections at the site perimeter, and all dimensioning is complete.			
Based on review of the Geotechnical Report, adequate soil testing has been done within the proximity of the building construction, including potential areas of expansion.			
Declaration of Soil Bearing Capacility and Decalaration of Uniformity of Soil Conditions have been signed and included with the Geotechnical Report.			
State code and environmental regulations have been identified and are being followed as described in the narrative and code analysis.			
The Environmental Impact Statement requirements are being followed in the design.			
SITE / CIVIL - GENERAL			
Calculation confirms that the authorized amount of parking is being provided.			
Review of the site plan indicates antiterrorism standoff areas are in compliance with the project-specific threat assessment and allow for potential future expansion by review of the site plan.			
Check of the site plan indicates security perimeters are clearly defined and have no breaches.			
SITE / CIVIL - SUSTAINABILITY			
SPiRiT Review of the narrative confirms that all site design sustaniable goals have been clearly defined and are realistic within the project budget. (Support documentation for the SPiRiT program is being developed and included in documentation at each milestone as the project progresses.)			

Table 6-1. Design Review Directives

SITE AND CIVIL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SITE / CIVIL - BASIC DESIGN				
2200	Cut and fill calculations have been provided; based on review, they reflect balance, or the amount of off-site material required or on-site material removed has been determined.			
2200	General review of proposed final design grading reflects no extremes in topography, and retaining walls are indicated as necessary.			
2370	Based on check of the specifications, erosion control has been adequately addressed.			
2500	Based on review of the narrative and indications on the perimeter of the site survey, all available utilities have been indentified; they are of adequate size to support the new project based on appropriate calculations.			
2500	Based on review of related details, adequate protection of utility elements on grade is provided.			
2500	Based on review of the site plan, utility lines from connection at the site perimeter to the building(s) are the shortest practical distance.			
2501	The fire protection water loop is provided with hydrants placed as required by the local jurisdiction, and is confirmed in writing.			
2630	Based on review of the drawings and narrative, storm drainage design includes a retention basin with support calculations or a stormwater permit for off site drainage.			
2750	Pavement standards have been incorporated into the specifications and cover all conditions for drives, parking, walkways, and site structures.			
SITE / CIVIL - LANDSCAPING				
2810	Irrigation and landscape plans are coordinated for adequate sprinkler coverage based on plan overlay.			
2890	Facility signage meets standard and is adequate for all site entry points based on check of the site plan and specifications.			
2930	Landscape species are appropriate for the local environment based on related information included in the design narrative.			

Table 6-1. DESIGN REVIEW DIRECTIVES

SITE AND CIVIL ENGINEERING	SUBMISSION		
	CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SITE / CIVIL - COST ESTIMATING			
Based on review of the cost estimate, all of the items in the following categories required in the project design have been adequately addressed: Site preparation and demolition Site improvements and landscaping Site utilities Connecting tunnels and bridges Other site systems			

Table 6-1. Design Review Directives

STRUCTURAL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SEISMIC DESIGN CONSIDERATIONS				
1102	An evaluation of the building configuration (plan and massing) related to transfer of seismic loads has been done and is included in calculations and narrative.			
	Building expansion joints and/or seismic joints are shown on floor plans.			
FOUNDATIONS				
3051	Any development restrictions or other recommendations of the geological investigation have been followed to including building size and location on site.			
3051	The foundation system is in compliance with the Geotechnical Report and takes into account expansive soils, corrosive soils, and any other special characteristics.			
SLAB ON GRADE				
3052	Floor slabs on grade are being designed based on the recommendations of the Geotechnical Report as described in the narrative.			
GENERAL REQUIREMENTS				
	Live loads have been selected to suit any special requirements of the project based on review of the calculations and narrative.			
	Review of the narrative indicates that equipment having excessive noise and/or vibration has been identified, and proper structural isolation is incorporated into the design.			
	Blast and progressive collapse studies have been included and explained in the narrative.			
	Provision of floating slabs to mitigate equipment noise and vibration isolation requirements are identified.			
	The design includes compliance with regard to accommodating maintenance equipment, and when the building is 40 ft or			

Table 6-1. Design Review Directives

STRUCTURAL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
	higher, details at the building perimeter are provided for service equipment supports.		■	■
	Structural systems have been coordinated with fire resistance requirements and protection is identified in the narrative.		■	■
SPiRiT	Specifications call for recyclable products in concrete and cement mixes to the maximum extent allowable, and to the maximum available in structural steel.		■	■
	Structural design has incorporated support for crane systems in maintenance areas.		■	■
	The cost estimate has been checked for inclusion of all structural system components.	■	■	■

Table 6-1. Design Review Directives

ARCHITECTURAL DESIGN		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
GENERAL DESIGN CONSIDERATIONS				
	Based on review of the space program and floor plan layouts, all program requirements are incorporated with optimal functional relationships.			
	Areas with incompatible noise and/or vibration tolerances are remote from one another or are segregated by neutral building elements.			
SPiRiT	The building orientation is in accordance with the site analysis and energy modeling.			
SPiRiT	The building massing configuration and envelop design are in accordance with the related architectural characteristics in the energy analysis model that is used to set the annual energy budget.			
	Building entry and circulation routes are in accordance with security assessment requirements.			
	Functional expansion capabilites have been thoroughly analyzed.			
	Custodial and designated facility storage areas have been sized and located appropriately, including direct loading dock access.			
	Dimensions are adequate for vehicular circulation at all service dock areas based on check of the accommodation of the largest vehicles anticipated.			
SPiRiT	Open office areas are not isolated from exposure to natural light by continuous perimeter enclosed functions.			
	A formal vertical transportation study has been performed by a specialist, and the results are reflected in the narrative and the building design.			
	Appropriate methods of access to the roof for servicing equipment are provided and approved in writing by facilities management.			
OSHA	Provisions are included for the method of compliance with OSHA Standard 29 in CFR 19.66 and ANSI A120.1 for accommodating maintenance equipment servicing when a building is 40 ft or higher.			

Table 6-1. Design Review Directives

ARCHITECTURAL DESIGN		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
	All acoustic performance requirements are met, and the method of achieving them is described in the narrative.			■
	Expansion joints needed due to the length of the building and configuration are determined by a structural engineer and indicated on the architectural plans.			■
SPiRiT	All interior pollutant-generating sources (copy rooms, janitor closets, chemical storage areas, etc.) are isolated with separate outside exhaust and slab-to-slab partitions.			■
	All exterior finishes have been defined in the narrative, details, and cost estimates.	■	■	■
8500	Based on calculations and the narrative, glazing systems are designed as low conductive thermal barriers.			■
	All interior finishes have been defined in detail in the finish schedules.		■	■
8710	All required hardware types are identified in the schedule.			■
	Power, data, and telecommunications connectivity at workstations and in meeting areas meet capacity and flexibility requirements.			■
	Building fire protection standpipe system is included on the drawings.			■
	Blast-resistant materials, systems, and details are integrated into the building perimeter with regard to the project-specific threat assessment.		■	■
	Review of details and specifications indicate that buildings in areas with severe weather conditions have entry mats integrated with grills or grates and drainage systems in vestibules.			■
	Dock levelers or scissor lifts are provided to accommodate various truck bed heights in the drawings and specifications.			■

Table 6-1. Design Review Directives				
ARCHITECTURAL DESIGN		**SUBMISSION**		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SPiRiT	Performance requirements for testing thermal resistence of the building envelop construction (thermal graphic imaging) have been incorproated into the specifications.			
10440	Review of details and specifications indicate that a comprehensive signage and graphics program has been developed based on a thorough review of paths of travel including all interior conditions, and meets standards.			
SPiRiT	Forrest Stewartship Council principles and criteria are met for specified wood products.			
SPiRiT	Paints and coatings comply with Green Seal standard based on review of specifications.			
SPiRiT	Adhesives and sealants comply with VOC content limits described in SPiRiT guidelines.			
NCRA	Roofing design and penetrations follow standards based on specifications and detail references.			
SMACNA	Flashing details follow standards.			
	The architect has confirmed, based on diagrams, that servicing and parts replacements can be accomplished within the dimensional limits of equipment rooms.			
	Based on the narrative, a minimum roof slope of 1/50 is provided and that the architect has coordinated this requirement with the structural engineer.			
	Based on review of details and specifications, dock areas are protected from extreme climatic conditions by overhead rolling doors and dock seals where appropriate.			
	Based on check of the specifications, overhead-supported toilet partitions are being used throughout the facilities.			
AWI	Based on specification requirements, all architectural woodwork is designed according to the AWI Quality Certification Program.			
	Suspended ceiling bracing is is incorporated where seismic zones dictates and related details are included in the drawings.			

Table 6-1. Design Review Directives

ARCHITECTURAL DESIGN		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SPiRiT	Based on specification, carpet systems meet or exceed the Carpet and Rug Institute Green Label Indoor Quality Test.			■
	Based on review of reflected ceiling and equipment plans, ceiling access to equipment above is through lay-in ceiling systems to the maximum extent possible.			■
	Cost estimate includes all architectural components.	■	■	■
10100 10670	All requirements for specialties including markerboards, tackboards, and shelving are included in the documents.			■

Table 6-1. Design Review Directives

MECHANICAL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
GENERAL DESIGN CONSIDERATIONS				
SPiRiT	The design target for annual energy budget has been determined and the mechanical design is in accordance with related modeling of the architectural design.	■	■	
	Utility service availability has been determined and outlined in the narrative.	■		
	The narrative identifies acoustic and/or vibration isolation needs for spaces near HVAC equipment.		■	
	The extent of sub-metering required has been determined in writing.		■	
SPiRiT	SPiRiT sustainability and energy conservation goals have been defined and continually reviewed for compliance.	■	■	■
	Functional layouts of architectural plans have been assessed to optimize efficient air handler zones, and zones are aligned separately between fully occupied areas and partially occupied areas.		■	
	Equipment will be located above the 100-year floodplain.		■	
SPiRiT	The building automation system will follow SPiRiT recommendations.		■	■
	Based on calculated service clearances and pathway dimemsions, adequate room is provided for major equipment replacement.		■	■
	Based on confirmation in writing, the facilites engineering staff has the training and expertise to maintain and operate the proposed HVAC systems and controls.		■	
	High maintenance equipment for every system has been described in the narrative.		■	■
	Based on description in the narrative, optimum flexibility is designed into the systems for classrooms, meeting spaces, and assembly halls.		■	■
	HVAC equipment will not be visable from the exterior of the building.	■	■	
SPiRiT	Effective methods for providing off-hour HVAC operation have been defined and are included in the narrative.		■	■

Table 6-1. Design Review Directives

MECHANICAL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
	Based on Life Cycle Cost Analysis, HVAC alternatives have been considered.		■	
	The limits imposed by value engineering decisions are clearly identified in writing.		■	
	An air flow balance for off-hours of operation has been calculated.			■
	The level of plant equipment redundancy has been established by the A-E and facility maintenance staff and is reflected in the preliminary equipment schedule and the narrative.			■
SPiRiT	A detailed preliminary Commissioning Plan, including requirements for implementation strategy, has been incorporated into the narrative and specification language.			■
SPiRiT	Economic viability of all SPiRiT credits is checked and updated at each phase.	■	■	■
	Description in the narrative indicates compliance wiith all seismic zone requirements for stabilizing equipment will be done.			■
	Provision is made for appropriate access to service equipment that cannot be maintained from ground floor level.			■
	Based on placement on the site plan drawings, underground or above-ground mounted storage tanks will not be located close to buildings, railroad trackss, or roads.		■	■
	Service agreements and appropriate durations are incorporated into the specifications, and a list of all necessary provisions is included in the narrative.			■
	Specifications call for all necessary training and a thorough spare parts list under each related category, and indicate the extent of the requirements provided as a list in the narrative.			■
	An analysis has been performed to verify the need of water treatment for boilers, humidifiers, and cooling towers; and if required, it is addressed in the specifications.			■
1-3.12	All warranty requirements for mechanical equipment are included in the respective specification sections, and all the specifc warranties are listed in the narrative.			■

Table 6-1. Design Review Directives

MECHANICAL ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
	Based on lisitng in the narrative, building automation system control and monitoring points meet minimum requirements.			
SPiRiT	Specifications contain instructions to bidders for documentation and product literature necessary to support the SPiRiT goals.			
	Cost estimate includes all mechanical system components.			

Table 6-1. Design Review Directives

PLUMBING ENGINEERING		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SPiRiT	The potential for gray water use is described in the narrative.		■	
	A metering strategy to effectively monitor water consumption from an overall efficiency standpoint is used and described in the narrative.		■	
	Water service, santitary drainage, and storm drainage calculations are completed and summarized in the narrative.		■	
	Domestic water heating approach (storage, instantaneous, circulated, points-of-use) has been determined and included in the narrative.		■	■
	Preliminary water pressure has been determined, and the narrative describes whether pumping will be necessary.		■	
	Requirements for sewage ejectors and/or sump pumps are identified in the narrative.			■
	Pipe and insulation materials have been identified in the specifications.			■
SPiRiT	The intent to meet or exceed water conservation standards is economically viable based on cost analysis.		■	
	Toilet fixture count is adequate for occupancy and accessible accommodation is being provided by standard as indicated in the narrative.	■	■	
	Geotechnical Report has been reviewed, and provision is included for foundation and/or underslab drainage system as indicated in the narrative and specifications.		■	■
	Specifications provide for grease interception and/or recovery for kitchen fixtures and drains.			■
	Based on check of specifications, fuel storage tanks are provided with leak detection and alarm.			■
	Natural gas meter and service pressure regulator are protected from vehicular damage, foundation settlement, and vibration by applicable methods indicated in the narrative.			■
	Cost estimate includes all plumbing components.	■	■	■
	Pipe sizes are coordinated with utility connections by check of the site survey information.			■

Table 6-1. Design Review Directives

ELECTRICAL		SUBMISSION		
		CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
SPiRiT	Commitments to energy management have been established including lighting controls and energy monitoring systems, and are indicated in detail in the narrative.			
	Based on analysis in the narrative, all existing building electrical systems and power source(s) are adequate for expansion or renovation loads.			
	Requirements for cathodic protection have been determined from the Geotechnical Report, and if needed are defined in the narrative.			
	All special equipment power requirements are identified by listing in the narrative.			
	Utilility rebate programs have been investigated for availability and apllicability.			
	The narrative indicates that adequate service and expansion space has been provided at major equipment locations.			
	The electrical system is being designed with adequate spare capacity by listing in the narrative.			
	Statement in the narrative indicates that all electrical equipment is located above the floodplain.			
	All lighting control conditions are defined in the narrative.			
	The site lighting design minimizes lighting intensity off site by incorporating directional fixtures at the perimeter.			
	UPS is provided in the electrical requirements for critical service items listed in the narrative.			
	Lightning protection requirments have been defined in the narrative.			
	A separate green, insulated equipment ground conductor has been incorporated into all feeder and branch circuits by specification.			
SPiRiT	Mercury-free transformers and lamps are being specified.			

Table 6-1. Design Review Directives				
ELECTRICAL		**SUBMISSION**		
		CONCEPT (10%)	**PRELIMINARY (35%)**	**FINAL (95%)**
	Emergency generators have adequate ventilation and are located away from HVAC air intakes; and sound and/or vibration isolation is provided.			
	Based on check of schedules, panels have at least one circuit breaker per 200 ft^2 of coverage in office areas.			
	Based on check of schedules, panelboards have adequate spaces and spares.			
SPiRiT	Daylighting sensors are called for on the building perimeter and included in the specifications.			
	The building automation system includes the requirements and has the capacity to monitor normal, emergency, and uninterruptible power; mechanical systems and controls; fire detection and suppression; security systems; lighting; communication equipment; gas; and exhaust.			
	Receptacles placed for cleaning are located in all open spaces and corridors.			
	Based on check of diagrams and floor plans, electrical service has been provided for all related site elements including lighting and security systems.			
	One emergency receptacle has been placed in each electrical closet, communications equipment room, mechanical room, and electrical equipment room.			
	Cost estimate includes all electrical system components.			
	Lighting power budget calculations have been provided if required by the energy code.			
	Door schedule indicates special items, including fire alarm hold open, security devices, and power-operated doors.			
	There is clear indication of division of work between building contractor and utility company.			
	Battery-powered lights have been provided in the generator and switchgear rooms.			
	A minimum of 10% spare breakers in panelboards have been provided.			

Table 6-1. Design Review Directives

ELECTRICAL	SUBMISSION		
	CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
All quantities of outlets, spacing, and type meet program requirements.			
Based on review, lighting calculations meet energy code			
Based on check of drawings, location of structural foundations and and electrical ductbanks are not in conflict.			
By check of schedules, all lighting type and space illumination levels meet program requirements.			
By check of schedules and code requirements, all emergency lighting requirements are met.			

Table 6-1. Design Review Directives

FIRE PROTECTION	SUBMISSION		
	CONCEPT (10%)	PRELIMINARY (35%)	FINAL (95%)
All Federal, state, and local codes and amendments are included in the narrative.	■	■	
The local water supply has sufficient capacity for future expansion of the fire protection system.	■	■	
Fire access roads are not in conflict with future building plans on the proposed site, and access is provided 24 hours a day when the roads are behind security barriers.		■	
The emergency generator has been specified with extra capacity for future loads as described in the narrative.			■
Water tank sizes have extra capacity for future expansion as described in the narrative.			■
UL assembly numbers, compartmentalization, rated walls, and penetration conditons are indicated on the drawings.			■
Based on check of the specifications, the fire alarm system includes capacilty for future expansion.			■
Dimensional check shows that the location of major fire protection equipment, to include fire pumps is accessible for service.			■
Fire extinguishers and/or cabinets are located on the plans.			■

APPENDIX D

FIGURES/LIST

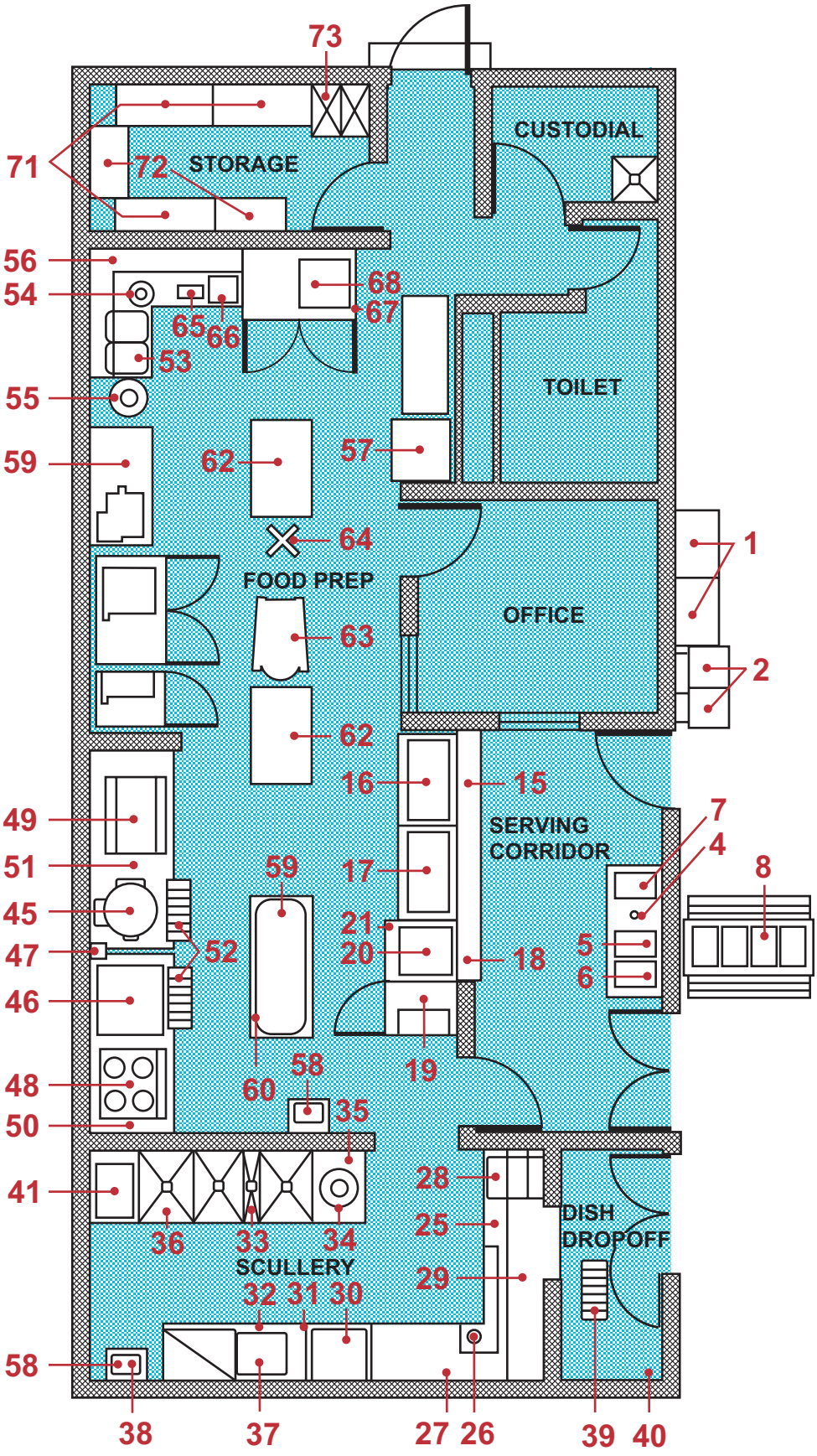

Figure 1. Small Kitchen Equipment Layout

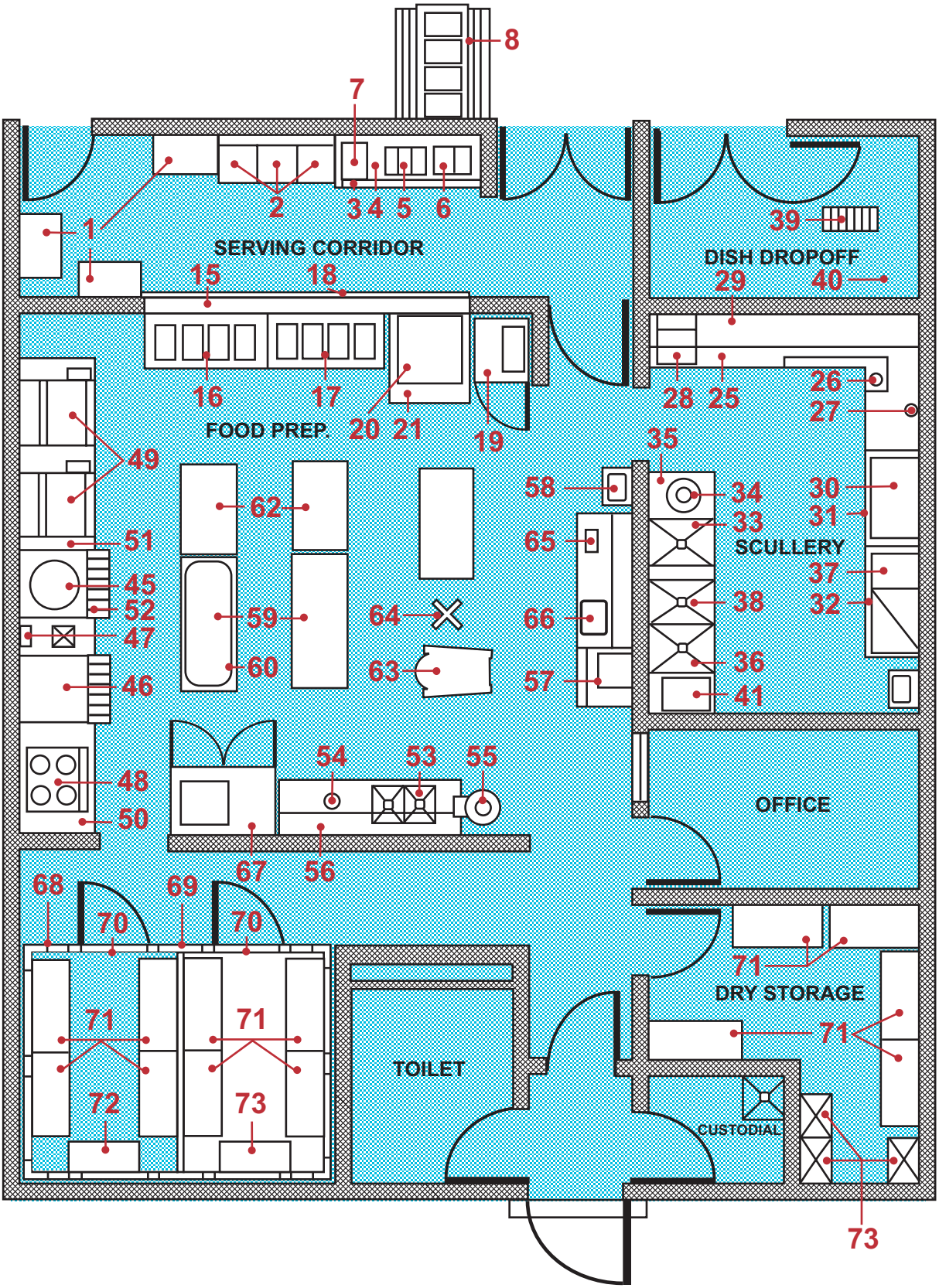

Figure 2. Large Kitchen Equipment Layout

Self-Serve, Beverage, Salad, and Dessert Areas:

1 Dispenser Regular -Service Tray and Silverware
2 Dispensers - Tableware
3 Stand - Drinks
4 Water Cooler
5 Dispenser - Juice
6 Urn - Coffee
7 Ice Dispenser
8 Cold Food Counter
9 to 14 Not Used

Serving Line Area:

15 Serving Counter
16 Cold Pan (Drop-in)
17 Hot Food Table (Drop-In)
18 Tray Slide
19 Food Warming Cabinet
20 Griddle
21 Exhaust Hood
22 to 24 Not Used

Scullery Area:

25 Soiled Dish Table
26 Garbage Disposal
27 Spray Assembly
28 Soaking Sink
29 Wall-Mounted Shelf
30 Dishwashing Machine
31 Exhaust Hood - Dishwasher
32 Dish Table
33 Pot and Pan Sink
34 Garbage Disposal
35 Spray Assembly
36 Water Heater - Under Sink
37 Water Heater
38 Exhaust Hood - Over Sink
39 Floor Trough
40 Spray Assembly
41 Water Heater
42 to 44 Not Used

Kitchen, Storage, and Refrigeration Areas

45 Steam Kettle - Jacketed
46 Frying and Braising Pan
47 Water Meter
48 Heavy Duty Range
49 Baking and Roasting Oven
50 Exhaust Hood
51 Exhaust Hood
52 Floor Trough
53 Vegetable Preparation Sink
54 Garbage Disposal
55 Vegetable Peeling Machine
56 Wall-Mounted Shelf
57 Ice Machine
58 Hand Sink
59 Food Preparation Table
60 Kitceh Utensils Rack
61 Not Used
62 Food Preparation Table
63 Food Mixing Machine
64 Mixer Stand
65 Can Opener
66 Meat Slicing Machine
67 Frozen Food Cabinet
68 Refrigerator
69 Refrigerator (Not in Small Kitchen)
70 Plastic Strip Doorway Closure (Not in Small Kitchen)
71 Shelving
72 Wall Lockers
73 Hand Shelf Truck
74 Air Curtain Machine (Fly Control)

Food Service Equipment List